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MACINTOSH™ EXPANSION GUIDE

GARY PHILLIPS AND DONALD J. SCELLATO

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Introduction

This book is the tool needed by every owner of an Apple Macintosh who wants to buy expansion hardware. We have chosen the best from hundreds of competitive products and reviewed them in an orderly and consistent format to make effective comparison shopping possible. The current version of the Macintosh is described in Chapter 2. One chapter is devoted to each major type of device, providing in-depth background knowledge. Evaluative reviews of the best available products and comparative tables of vital statistics and features are included in each chapter to assist you in selecting expansion hardware for the Macintosh. Two appendices provide further useful reference information, including addresses of user groups and Apple magazines.

One of the problems facing the owner of the Macintosh is that the Macintosh is a relatively new product that is intended to set a new standard in personal and business computing. The Macintosh may not always conform to standards set by previously released computers. Thus, much of the hardware that was released for other computers may not operate with the Macintosh unless specially prepared software is used or unless the hardware is adapted to the Macintosh in some fashion. In some cases, the hardware may be completely incompatible with the Macintosh. If you own another computer and purchase a Macintosh or upgrade your current system to a Macintosh, you may or may not be able to use the hardware expansion products you purchased for your other system. In this book we have been careful to note where the differences between machines make a difference in your decision. We have even noted where the difference in machines makes a device useful for one machine and useless for another.

Additionally, unlike other books which reproduce information from manufacturers' brochures, these reviews reflect hands-on use of the products. We point out the flaws and disadvantages of products, as well as strong points and features. The four opening chapters provide a comprehensive overview of the Macintosh and describe how the various devices are connected to the computer. We describe a systematic process for using the reviews and the accompanying tables to find the best expansion products for your special requirements. Hundreds of hours have gone into the reviewing process, and you can have the benefit of all of this research in a few hours of reading.

This book can help you wade through the sometimes confusing product choices available to you. Now you can select the products best suited to your needs quickly, accurately, and confidently. You can be sure to avoid overpriced but underperforming products, thereby getting the greatest possible computing power for your money.

Chapter 1

Price, Performance, and Quality

January 13, 1984, was a day of anticipation for the users of microcomputers and a day of pride for Apple Computer, Inc. in Cupertino, California. The Macintosh was introduced that day in the electric atmosphere of Apple's annual shareholders' meeting. The announcement was accompanied by the strains of the theme from *Chariots of Fire*. It was accepted by those in attendance with loud and sustained applause. This introduction signaled Apple's intention to deviate completely from the IBM standard that had been in place since late 1981. It also signaled Apple's intention to continue as the innovator in the microcomputer marketplace.

COMPUTER SYSTEMS AND THEIR COMPONENTS

By the end of 1984, more than 275,000 Macintosh computers had been sold. A large number of hardware and software manufacturers had committed resources to the development of hardware and software products that could be used with the Macintosh.

Hardware is best described as tangible items that expand the utility of a computer system, as well as the tangible components of the computer system itself. The computer itself, its keyboard, a separate video monitor, a printer, a modem, and a plotter are all examples of hardware. The first three items are integral parts of a computer system. The last three items are not essential to the system itself, but may be required for the system to do the things the user wishes to accomplish. Such items as these are called *peripherals*, or *expansion hardware*.

Although software is less tangible than hardware, it is no less essential to the

operation of the system. Software is usually conveyed in the form of some physical medium such as a disk, a tape, or a cartridge. This physical medium acts as a storage device for the electromagnetic signals that can be transferred into the computer's memory in a format dictated by the computer's operating system and then transformed by the computer into useful programs.

The computer's *operating system* oversees the management of the computer's electronic memory and defines the manner in which the computer communicates with external peripherals such as printers and mass-storage devices. The *disk* is the medium used by a mass-storage device to store programs and data. The mass-storage device that writes to and reads from this medium is called a *disk drive*.

GENERAL DESCRIPTION OF THE MACINTOSH

The Macintosh can best be described as a *closed computer system*, or a computer system with a closed architecture. Closed computer systems cannot be easily opened for insertion of printed circuit boards that allow the computer's memory to be expanded, allow the connection of peripherals, allow its video output to be altered, or allow the computer to operate as a completely different type of computer.

Memory can only be expanded by opening the case and replacing the memory chips on the board that contains these chips, by unsoldering the chips currently on the board and replacing them with new higher-capacity chips, or by completely replacing the circuit board that contains the computer's memory chips with a circuit board containing higher-capacity chips. Peripherals are connected to the system via ports in the rear of the computer's case. These ports are controlled and supported by circuits that are contained on circuit boards inside the computer's case.

INTERFACES AND EXPANSION HARDWARE

An *interface* may be defined briefly as a hardware device complying to a standard defining the types of connections (plugs), the electrical specifications, and the sequences of control signals that allow a computer and a peripheral to work together. The interface bridges the gap between the Macintosh and a peripheral. Since the Macintosh is a closed system, all of the circuits that support its use of and communications with external devices are built-in. All of these circuits within the Macintosh are *serial circuits*, which pass one bit of information at a time between devices that are connected to each other. Parallel interfacing is not permitted by the Macintosh's circuits. If you will use a parallel device with the Macintosh, you will need a serial-to-parallel converter.

Many peripherals made for a variety of personal computers, such as printers and modems, comply to interface standards available on the Macintosh. They include RS-232C serial devices like modems, and serial printers. The Macintosh serial interface circuits really are designed to support the RS-422 standard. This standard is slightly faster and slightly more efficient than the RS-232C standard. The Macintosh's serial circuits, however, work quite well with the RS-232C standard devices, as well as RS-422 standard devices.

Many accessory hardware products are available for the Macintosh user through the expansion interfaces built into the Macintosh. The problem of making a wise

choice among these peripherals is very similar to the problem of choosing a computer. Peripherals span a broad range of prices, performance, and quality. It is not always true that the most expensive peripherals have the highest performance or the highest quality. Many peripherals are significantly overpriced and some have fatal flaws.

REVIEWS

In the chapters that follow, we will give you a general background as to how the various peripherals work, what they are good for, and what features and pitfalls you should look for in the various devices. We have examined a broad cross section of available devices that can be used with the Macintosh from a number of viewpoints.

We have rated the various devices for at least five basic categories. The *overall rating* is our subjective summary of all of the pluses and minuses for this particular device as contrasted to the others that are available. The *price/performance rating* measures the performance of the device in view of its price. *Ease of installation* contrasts those devices that require significant labor and trouble to install versus those that simply plug in. The *documentation* is rated as to its clarity, completeness, and overall quality. We have also provided a rating for the quality of *vendor support*, including such factors as repair, warranty, and availability of technical advice, and, where applicable, a rating for *software compatibility*.

The various features for each type of device are listed in a consistent format. All of the information for a given type of device is summarized in tables, allowing rapid and easy comparison of all the devices of a certain type. In addition, for each type of device, such as printers and disk drives, we will give you our personal recommendations. In some cases there is one device that is so outstanding in all respects that we can simply recommend it as the device to purchase. In other cases, the device that will be of greatest value to you will depend on what your particular needs are. For example, many fine dot-matrix printers will not adequately do the job of presenting an acceptable business or personal letter. Several letter-quality printers are available for use with the Macintosh. The use of these printers is fine where the printed word and printed numbers are of prime concern. These printers, however, are not useful for producing high quality graphics for artistic or for business purposes.

Because price, quality, and performance are not as closely related as they may appear, there are many pitfalls of which you should be aware. The other side of this coin is that there are many bargains to be had by the informed purchaser. The purpose of this book is to give you the necessary background information to make knowledgeable hardware expansion choices.

DIFFERENT SYSTEMS FOR DIFFERENT PURPOSES

The Macintosh has almost unlimited potential for assisting in the performance of various tasks, ranging from business applications to entertainment and education. For any particular application that you may wish to pursue, you will need to acquire appropriate peripherals.

There is no particular peripheral that all Macintosh users would need to have except for a second disk drive and a printer. The peripherals you will want to add to your system depend totally on what you want to do. For example, if you are an avid computer game player, you will certainly want to add a joystick and other game-related items to your computer. If your main application is word processing, you probably will want a good-quality printer, possibly with fully formed characters, and a second disk drive on which to save the documents you create. Business applications will generally require a disk drive and a printer. As the volume of work and of documents increases, both additional RAM—available through a variety of memory upgrades up to 2 megabytes—and large-capacity disk storage become desirable.

Finally, your interest may be in tapping the many on-line databases and the community of personal computer users available through the use of a modem and phone lines. Telecommunications and the use of a modem may also play an important role in programming, processing business applications, or otherwise using the Macintosh. Having a modem opens up a whole world of possibilities, knowledge, interaction, and availability of free software from the public domain. If you are a developer or a programmer, it will provide access to other developers and programmers and can even provide you with a direct link to Apple Computer, Inc. via Dialog or CompuServe.

Whatever your major purpose for expanding your Macintosh, there will be different candidates for your purchase. This book will guide you to finding the best value for your money and help you avoid the agony of paying good money for a device that does not work properly.

Chapter 2

The Macintosh Computer

Since the introduction of the Macintosh in 1984, Apple Computer has renamed a larger version of the Macintosh, the Lisa 5/2, as the Macintosh XL and then subsequently discontinued this computer. The company has increased the random access memory from the 128K contained in the first release of the Macintosh to 512K as an optional memory size. It has also introduced the LaserWriter printer and the Macintosh Office. The Macintosh Office is a work group concept that links up to 32 Macintoshes to each other and to a single LaserWriter. The linked computers can share files and use such office automation tools as electronic mail through a device called a *file server.*

Apple Computer, Inc. has not been alone in its efforts to give the Macintosh more power and capability through memory expansion and peripherals. The Macintosh has captured the imagination of many well-known hardware and software manufacturers. These manufacturers are releasing new products for the Macintosh on a frequent basis. Other manufacturers are finding methods through software and through connecting devices to make products released for general use by other personal computers compatible with the Macintosh.

THE MACINTOSH

The basic Macintosh computer system (Fig. 2-1) is made up of three components: the computer itself, a keyboard, and a pointing device called a *mouse.* The computer is housed in a case that holds the circuit boards containing the computer's Central Processing Unit (CPU) chip, other chips that allow the computer's CPU to control

and communicate with internal memory and external devices, the computer's random access memory, the computer's read-only memory, and those circuits that tie all of the chips and devices together. The computer's case also contains a high-resolution display screen and *ports,* or sockets, that enable the various devices supporting the computer and supported by the computer to be connected. It also contains audio circuits for a four-voice sound system, an internal clock, an internal single-sided disk drive with a 400K 3 1/2-inch disk-storage capacity, and an internal speaker.

The three components making up the basic Macintosh system enable the computer to perform its tasks, to communicate with the user, and to enable the user to communicate with the computer. The computer communicates with the user in this basic system through the display screen and the internal speaker. The user supplies the computer with information and instructions through the keyboard and the mouse. Table 2-1 gives technical specifications for the basic Macintosh system.

PERIPHERALS

Although the basic computer system is a wonderful system to use and it has a lot of computing power presented to the user in a convenient fashion, most users require more from their computer system than a basic system has to offer. Some users require additional memory to deal with complex programs. Most users require hardcopies of the documents produced by an application or program. These users find their system to be of no use unless a printer is attached. Other users may need to communicate with mainframe computers or other personal computers. They will find a modem absolutely necessary. Others may require a second disk drive or a large-capacity storage device such as a hard disk system for their computer system. Some users may require a larger screen display than the Macintosh's internal display. These users may need a large-screen, high-resolution monitor or a projection device to make presentations. Input devices such as graphics tablets, video digitizers, joysticks, or trackballs may be of value to other users.

The Macintosh system already contains the equivalent of two built-in serial interface cards.

Macintosh owners can use an *external modem*; that is, a modem requiring connection to a serial interface. They cannot, however, use a modem that is designed to be plugged into an expansion slot in a computer's motherboard.

Although the Macintosh has its own built-in screen display, there are occasions when you may require an external monitor or a projection device.

One of the joys of using the Macintosh is its superior handling of graphics. A device that takes advantage of the graphics capability of the Macintosh is a *digitizer.* This device converts video input signals to images that can be displayed on the Macintosh's screen.

Disk drives can be used by the Macintosh; however, a particular connector is required for connecting the drive to the Macintosh. There are some converting cables available, although these only work with fairly standard Macintosh drives or look-alikes.

Although the Macintosh has a closed architecture, Apple Computer, Inc. and other vendors offer memory expansion for the Macintosh.

Fig. 2-1. A Macintosh system that has been expanded to use an ImageWriter printer and a Bernoulli Box hard disk (courtesy IOMEGA Corp.).

Pointers vary tremendously in the manner in which they function. A variety of such devices is available.

Table 2-1. Macintosh Technical Specifications.

Memory:	128K or 512K Random Access Memory 64K Read-Only Memory		
Processor:	MC68000, 32 bits, 7.8336 MHz clock frequency		
Disk Storage:	Internal 3 1/2-inch 400K-capacity disk drive		
Screen Display:	9-inch diagonal, high-resolution, 512 pixel × 342 pixel bit-mapped display		
Interfaces:	Synchronous serial keyboard bus Two RS-232/RS-422 serial ports Mouse interface External disk interface		
Sound:	4-voice sound with 8-bit digital-analog conversion		
Input:	Line voltage (US): 105 to 125 volts ac Frequency: 50 to 60 Hz Power: 60 watts		
Keyboard:	58-key, 2-key reliever, software-mapped, optional keypad		
Mouse:	Mechanical tracking, optical shaft encoding 3.54 pulse per mm of travel		
Clock Calendar:	CMOS custom chip with 4.5-volt user-replaceable battery backup.		
Size and Weight:	**Main Unit**	**Keyboard**	**Mouse**
Weight:	16 lb 8 oz	2 lb 8.5 oz	7 oz
Height:	13.5 in	2.6 in	1.5 in
Width:	9.7 in	13.2 in	2.4 in
Depth:	10.9 in	5.8 in	4.3 in

Chapter 3

Macintosh Hardware Shopper's Guide

In addition to deciding which peripherals to buy, you also need to give some thought to where and how to purchase the equipment. There are at least four major alternatives. The most obvious and simple alternative is to go to a local computer retail store and purchase the item you want. Even within this area, however, there is usually a substantial difference in prices and service. There are discount stores, and most nondiscount stores occasionally have sales. Another alternative is to order expansion products from a mail-order source where prices can be substantially lower than a retail outlet. In addition to these sources, computer fairs often offer an unusual opportunity to do comparison shopping and purchase items at substantial discounts. Finally, you can find used equipment through the want ads, user's groups, store bulletin boards, electronic bulletin boards, and similar sources.

SMART SHOPPING AT RETAIL STORES

Shopping at local retail outlets is perhaps the simplest and most common way of purchasing expansion products. There are substantial differences in retail prices of expansion products among these outlets which may or may not be related to the levels of service that they offer. Discount dealers often only offer a minimum amount of support in explaining how to use a product, helping to set it up, and in troubleshooting as you experience problems.

If a device has good documentation and good vendor or manufacturer support, and is relatively easy to install, support from the retail organization may not be critical. An important factor here is your own level of familiarity with electronic devices and

with the Macintosh computer. If you are not technically inclined, it may well be worth the extra price to purchase from a specialty store that can show you how to install and use the device. On the other hand, if you are relatively familiar with the Macintosh and expansion devices for it, you will probably want to get the very best price you can and rely on the vendor or manufacturer for any support or assistance you may need. If you plan to mix Apple and non-Apple expansion products for the Macintosh and want high-quality support, your best plan would be to find a full-service dealer who offers all the products you want.

As you become more familiar with the Macintosh and as your experience grows, you will see that most expansion products for the Macintosh are extremely simple to install. Most of these products only require connection to one of the expansion ports on the back of the Macintosh's case. The documentation that accompanies most expansion products for the Macintosh is quite complete and quite clear. Printer manuals and modem manuals for generic products that have been adapted for the Macintosh are an exception to this rule. These manuals may have appendices that explain Macintosh installation, or they may have no explanation of how to install the product on the Macintosh. In either case, you may be able to figure it out yourself. If you are having problems, consult the manufacturer.

In addition to differences in prices from one store to another, many stores have occasional sales when they will mark down prices significantly, sometimes by as much as 40 percent or more. In many cases, sales personnel at these stores are willing to give you some information as to the frequency of their sales and any sales coming up in the near future that might include products in which you are interested. It may be worth waiting to make your purchase at the sale price, or you may be able to convince the salesperson to give you the sale price now.

Keep in mind also that while there are often suggested retail prices for various products, salespeople and store management nearly always have some flexibility on price. If you were making a major purchase, such as a printer or a modem, it may well be worth your while to negotiate the price, to make an offer less than the store's asking price. While some stores will indignantly refuse to consider such an offer, others may very well agree to a negotiated price lower than their standard asking price. In other cases while they may be inflexible on price for a particular product, they may be willing to throw in a box of paper, a box of disks, or some other item that you would otherwise have had to purchase. This "sweetening the deal" may make it possible for you to get what amounts to a discount on the product without the store needing to bend its rules on the pricing. Occasionally hardware manufacturers will "bundle" software with their product to entice people to make a purchase. An example of bundling would be Haba Systems current practice of selling its external disk drive for the Macintosh with a copy of HabaDex, an index card type of database program. In many cases, you will find that the hardware and software offered together represent a large savings to you compared with making separate purchases of the products offered in the package.

If you are an employee at a large company that purchases many computers, look into any company discounts to which you may be entitled. Check with the purchasing department; sometimes companies establish a good rapport with local retailers, passing along any price breaks to employees. Quite often, a company will buy more

computer systems than it needs, selling the excess to its employees at reduced prices. You may also be eligible for discounts through a user's group, club, or even a college or university you may attend. Apple Computer, Inc. has made arrangements with many colleges and universities regarding special prices for the Macintosh and other Apple products. These colleges and universities are members of the *University Consortium*. If you are a college student or if a member of your family is a college student, this avenue is worth investigating.

A factor to be considered in pricing is the degree to which the vendor can support you. The personnel at some computer specialty stores may be able to give you some advice regarding products that are big sellers in the marketplace. They may be unable to assist you with lesser-known devices. The last resort for support concerning devices is the manufacturer or vendor of the product itself.

SMART MAIL-ORDER SHOPPING

An alternative to shopping in retail stores is to examine the mail-order advertisements in the various computer magazines, available at newsstands or by subscription (see Appendix C). Mail-order prices are typically much lower than standard retail prices. Some mail-order houses have acquired an excellent reputation for prompt delivery, and in many cases, even for providing excellent support by telephone. Examine the advertisements to see what support features they have to offer. If you are at the point of making a purchase, you can call the vendor concerning the product and inquire about its support policies.

Keep in mind, though, that some purchasers have had difficulties with mail-order sources. Products have sometimes been delivered after long delays or never delivered at all. Incorrect products may have been delivered. The best way to find out about a particular mail-order organization is to talk with other Macintosh users who have made purchases from that company.

We have chosen not to report on the reputations of specific mail-order vendors because it is subject to rapid change. A vendor who has an excellent reputation at one moment may encounter some difficulties, or a vendor who has a good reputation in one area may have a different reputation in another part of the country.

There are a few steps you can take to help protect yourself. Wherever possible, use a charge card to make purchases. Mail-order purchases made by charge card provide you with some additional protection if merchandise is never delivered or is faulty in some way when delivered. This protection varies among states. You may need to consult the agency that issued your credit card in order to learn exactly what your rights as a credit-card purchaser are.

We would like to emphasize that, while there are potential difficulties with purchasing items by mail order, there are also many advantages. Many of the devices we use in our personal Macintosh systems were purchased by mail order, and we have often been delighted with the delivery, service, and prices offered by mail-order firms.

SMART SHOPPING AT COMPUTER FAIRS

A third way of purchasing expansion products is to visit a computer fair. There

are many different types of computer fairs; look particularly at the consumer ones.

Watch the calendar of events in general personal computer magazines such as *MacWorld* and *A+* for announcements of these computer fairs. Consumer-oriented fairs are often attended by mail-order firms who make direct, over-the-countersales at mail-order prices. This practice gives you the advantage of getting your equipment immediately. You can make certain you are getting the correct items, and you have the opportunity to look at the exact item you are purchasing and ask questions about the product and the support offered by the mail-order house prior to making the purchase. Computer fairs offer an extraordinary opportunity to do comparison shopping. Various competitive products are often all available for inspection on working computer systems. You can also compare vendors for price and support.

Pricing at computer fairs is often significantly discounted from standard retail prices. There may be some flexibility for bargaining, particularly on the very last day of the fair. In the closing few hours of the fair many vendors will offer extraordinary bargains on unsold products.

SMART SHOPPING FOR USED EQUIPMENT

Another way of acquiring equipment is to look for used products. Used equipment is often advertised in the want ads of local papers, in computer specialty newsletters which circulate in many areas of the country, in club newsletters, or at the meetings of various user's groups (see Appendix A). There may also be computer swap meets in your area. Individuals can bring used equipment to these meets to be offered for sale. A number of companies specialize in rejuvenating computer systems they have used for 1 to 5 years. These companies examine each component and ensure that it is working. Then they offer the computer with or without its peripherals for sale to the general public. Sometimes they sell the peripherals separately from the computer system. Check your local newspapers if you live in a major city. Some of these companies offer a warranty for the systems and peripherals they sell.

There are obviously special precautions to be taken in buying used equipment. Unless you know the seller personally, it would be unwise to purchase any peripheral equipment without seeing it actually function correctly. Even then it would be wise to insist on a brief written warranty of at least 1 week. It is altogether possible that a device may function correctly during a brief test, but fail in some other situation or type of use, or after some period of use. If you buy used equipment at a swap meet, be sure to obtain the seller's name, address, and phone number so you can contact him if any problems arise.

If you do purchase a piece of used equipment, try it extensively in the kinds of applications in which you will be using it during the period it has been warranted; return it if any problems arise. It is also desirable to pay by check for any used equipment. In the event of a dispute arising over the serviceability of the equipment, you have the option of stopping payment on the check as a way of acquiring some leverage in the negotiations over the sale of the equipment. It would be wise to check on the legality of this measure in your particular state, as the laws are different among states.

There are several factors you should keep in mind when buying used equipment that will help you decide whether or not the price is reasonable. One is that many

devices have moving parts and have a finite working life. If a printer has printed many thousands of pages, some part of its useful life has been used up. This should be taken into account in its pricing. Similar considerations apply to all other devices that are subject to wear and tear.

Additionally, you should be sure that you are getting all of the components that come with the new equipment, especially the documentation. Attempting to use a piece of equipment without the documentation is frustrating. Although it may be possible to secure a copy of the documentation from the manufacturer, it may take a long time. It may not even be possible, based on the manufacturer's policy or the discontinuation of particular products or versions of products.

BACKGROUND INFORMATION

Whatever avenue you choose for purchasing expansion hardware, it will be useful to you to have background information about the particular product. The introduction to each chapter covering a particular product is intended to give you the necessary background to make an informed and intelligent purchase, whether you buy from a retail store, by mail order, or at a computer fair, or purchase used equipment.

Chapter 4

Methods of Evaluation and the Selection Process

The following chapters provide you with a complete guide to peripherals for the Macintosh. Each chapter is devoted to one type of hardware device and consists of four sections:

- ☐ Background information
- ☐ Reviews of available products
- ☐ Worksheet for reviewing additional products
- ☐ Comparative table of ratings and features

The main focus is on the five major peripherals of interest to Macintosh users: interfaces, printers, disk drives, monitors, and modems. However, a variety of other devices are also reviewed in separate chapters.

BACKGROUND INFORMATION ON A TYPE OF DEVICE

The first step toward making an intelligent choice of a peripheral is to have a general understanding about it. Each of the following chapters opens with a tutorial on one type of device to give you the background information and understanding you need to digest the reviews that follow it. It also allows you to find the best value for your particular peripheral needs. We have tried to provide you with a "short course" in the nature, function, and value of each major type of peripheral.

THE REVIEWS: METHODS OF EVALUATION

We have used a combination of methods in evaluating and reviewing the various hardware expansion products for the Macintosh. While the main part of our evaluation has always been first-hand use of the products described, we have not felt this was adequate. In spending a few hours using and testing a piece of hardware, it is altogether possible that either major advantages or disadvantages of the product will be overlooked. Many such advantages or disadvantages would show up only with extended use in a broad variety of situations. Therefore we have used information from a number of other sources.

Wherever a review written by another reviewer exists, we have read the comments and verified any points concerning strengths and weaknesses of the products. We have also relied very heavily on informal reports provided by our associates who have used the products over long periods of time. While these Macintosh users did not write reviews of the products, they did supply us with their experiences as to the strengths, weaknesses, and features of the products. Our final reviews are a combination of testing the products by members of our review team, information collected from other reviews and the manufacturer's literature, and interviews of long-term and intensive users of the products wherever possible.

A TO D RATING SYSTEM AND LIST OF FEATURES

We have rated most of the products on the same criteria. Some differences in criteria for some types of expansion devices were required to provide an accurate evaluation of the product's worth. In addition, we have provided a consistent list of features for most of the types of products for comparative purposes. The criteria were evaluated on the basis of written definitions and the ratings are on an A through D scale. The A rating was given only to products which were truly outstanding on a criterion. B indicates excellent performance without serious flaws. C indicates that there are at least a few weaknesses in the area described. D means the product was unacceptable for some reason in this particular criterion.

SELECTION OF PRODUCTS FOR REVIEW

Many products were not reviewed because they were not available to us or because we felt that either their price or performance did not make them significant candidates for purchase. It is also possible that we may not have been aware of the existence of some products not advertised in major computer publications.

We have reviewed most of the products that will be frequently encountered in retail outlets or in advertisements from the manufacturers and other vendors in the popular magazines. It is quite possible that some item you are familiar with is not found in this book. Because the market is changing so rapidly, we have chosen to only discuss those products that are easily available and have an established user base.

In this book we have taken advantage of the large number of products available to create a real cross section of prices and functions. A list of criteria has been established and applied to every device reviewed. It will allow you to realistically find out how a product compares to its competition. At the end of each chapter, we

have provided a summarized comparison chart including the devices we have reviewed.

THE FIVE CRITERIA USED IN EVALUATING PRODUCTS

The *overall rating* indicates the review team's general impression of the quality and performance of the device when all factors are taken into consideration. It includes quality, price/performance, support, documentation, ease of installation, and any special characteristics that might not have been otherwise rated.

The *price/performance rating* indicates how much performance you are getting for your dollar. An especially cheap peripheral might receive an A price/performance rating even though its overall rating might only be a B. This indicates that while it is by no means outstanding among products of its type, it is an outstanding bargain at its price.

Ease of installation refers to the simplicity with which the device can be attached to and used with the Macintosh. An A rating would apply to a device which attaches in an extremely simple and straightforward way to a Macintosh and is also convenient to operate once installed. Devices that require complex assembly steps and/or multiple switch settings would receive a lower rating. A D rating would ordinarily indicate that some fabrication steps such as soldering, adjustment of parts, or acquisition of parts not supplied with the device were required in order to make it work.

The *documentation rating* reflects documentation supplied by the vendor with the device in terms of its completeness and clarity, and the degree to which it enables an untrained user to efficiently use the device.

Vendor support reflects warranty terms, availability of technical support—whether from retailers or directly from the manufacturer—and service availability both within and beyond the warranty period.

In a few cases an additional criterion relevant to only one type of product has been added to the standard list of five rating criteria. For example, the software compatibility of a printer is a significant determinant of the usefulness of the product. *Software compatibility* is used in this case as a criterion for rating.

STRUCTURE OF THE REVIEWS

Within a review itself, the product summary gives a description of a product and its general features. Price/performance may be mentioned here to give you a general idea of the value of the product. We may also discuss how easy or difficult the device is to integrate with your existing system.

We will usually describe the general quality of the device and how it performs in terms of speed, durability, software compatibility, etc. High-quality features are mentioned, as well as any problems or disadvantages. The overall usefulness and the best possible application of the product may be described.

The vendor support rating is often supplemented by stating warranty terms, technical support, and any other relevant information you will need to get answers to questions or help with problems.

Within any particular product, some additional sections may cover topics of in-

terest to that product only. For example, for printers we cover features for word processing and features for graphics.

GROUPS OF RELATED PRODUCTS REVIEWED TOGETHER

Often a family of related products differ only in one or two particulars and in price. An example is printers, where two or more models often differ only in the width of the paper carriage and in price. All other specifications tend to be identical. In such cases we have covered the group of related products in a single review. In the Table of Contents and in the comparative tables at the end of each chapter, each product is listed separately. The reviews are in alphabetical order by product name.

WORKSHEET FOR ADDITIONAL REVIEWS

New expansion products for the Macintosh appear each month. A new product could represent a better price/performance value than any of the products reviewed in this book, or it may be overpriced. We have provided a blank review form in each chapter to allow you to organize information about a new product for easy comparison with the products reviewed in this book. In this way, you can easily include new expansion products in your search for the best values for your growing computer system.

COMPARATIVE TABLE OF RATINGS AND FEATURES

It is often difficult to keep the ratings and features of a number of products in mind for comparison. We have, therefore, provided a comparative table of the ratings and features of all products in a chapter. This table allows you to quickly compare various devices for a feature or rating. You may easily eliminate those that do not have features you need or that are rated as inferior.

THE HARDWARE SELECTION PROCESS

Selecting hardware is one of your most important undertakings as a Macintosh owner. Your computer can do marvelous things with good expansion hardware. Without good expansion products, however, it is very limited. Three fundamental assumptions underlie our discussion of hardware selection:

- ☐ You have a goal in mind that you expect the hardware and your Macintosh to help you accomplish.
- ☐ Your time is limited and valuable.
- ☐ You have a limited budget for computer hardware.

These assumptions will not apply to everyone. If you are a computer hobbyist, you may enjoy spending 10 hours reading and researching each of dozens of hardware devices, keeping careful notes on each of them. Perhaps you can afford to buy hundreds or thousands of dollars worth of hardware to compare. If you are like most Macintosh users, however, your time and budget are limited. You will need to con-

duct a systematic and efficient survey which quickly finds a device that will serve your ultimate purpose at a reasonable price. Your time will then be spent learning to use this device and accomplishing your larger goals.

An excellent way to start your search for a suitable device is to separate the features for the type of device (as listed in the review section of this book) into three groups, based on your particular objectives in using the device:

- ☐ Features required to achieve your goals
- ☐ Features that might be useful but are not required
- ☐ Features that would be a nuisance or dangerous (i.e., exposed electrical components)

Once you have sorted the features in this way, you can quickly eliminate those devices that lack essential features or contain objectionable ones. A few devices should survive this first cut. These can be further compared, based on features that are useful but not required, or on the more general criteria of quality and price.

You probably do not have time to carefully examine each of a large number of hardware devices of a given type, nor would you want to clutter your mind with all the special features and options of all these devices. The first step in the selection process might well be to eliminate from consideration as many devices as possible. The comparison chart at the end of each chapter allows a simple and rapid elimination of devices that lack features you have identified as necessary for your intended purpose. Similarly, a device that offers objectionable features may be eliminated. Any that are clearly beyond your budget limitations can also be crossed off.

Pick the ones that have the highest ratings and the most features from among the survivors. Read the detailed descriptions of these and select a small number which you can realistically expect to examine in detail. You may want to write to the manufacturers of these devices for more detailed data. With some perseverance, you may be able to try out all of your particular candidates at a retail store and make your final decision based on the first-hand use of the device. You may also want to compare notes with other users of the final contenders by talking with friends and members of your user's group who have used the device.

We trust that you will find the following chapters useful to you in acquiring a general knowledge and appreciation of a particular kind of product. We trust that evaluative reviews of each product and comparative presentations of the various products of a given type will save you time and will assist you in reaching your decision as to which product to buy.

Chapter 5

Dot-Matrix Printers

When the Macintosh was introduced, there was only one printer that could be used with the computer. This printer was the Apple ImageWriter printer, a dot-matrix printer that interfaced with the computer through the computer's built-in RS-232/422 serial circuits. The printer was connected through the computer's printer port on the back panel. The software that ran on the Macintosh used a *printer driver* (printer control program) that was set up to use the ImageWriter. Within 6 months of the Macintosh's release, a number of printer drivers were being marketed that allowed the Macintosh to use printers other than the ImageWriter. Software such as Microsoft Word, a word processor, had additional printer drivers on the Program disk. These printer drivers enabled this program to use a wide variety of printers.

One year after the Macintosh was released, Apple Computer, Inc. introduced the LaserWriter, a sophisticated laser printer that could be used by the Macintosh and by other computers such as the Apple *II*c and the IBM PC. This chapter describes the ImageWriter and other dot-matrix printers that may be used by the Macintosh, provided that you have purchased programs that supply the required drivers, printer utility disks that provide the proper drivers, a cable that matches the computer to the printer, and possibly a serial-to-parallel converter if the printer uses a parallel interface rather than a serial interface.

Since the Macintosh uses a serial interface to communicate with printers, you should purchase a serial version of the printers described. If you already own a printer that uses a parallel interface, or decide to purchase a parallel interface printer, you will require a serial-to-parallel converter to change the signal sent by the Macintosh to a signal the printer can understand. Such devices are readily available but they

could be an unnecessary expense. They are described with buffers in Chapter 7. The programs that are on the market allow the Macintosh to use more than 50 printers of varying types, including dot-matrix, daisy-wheel, and laser.

Today there are many printers from which to choose. They may be divided into two major categories: dot-matrix and fully formed. The *dot-matrix printer* produces a pattern of dots which approximate the shape of a letter. This chapter reviews a variety of dot-matrix printers. The best of these, such as the Apple ImageWriter and Epson LQ-1500, use a large number of very closely spaced dots to produce characters that look very much like those printed by a typewriter. You may find the output from such printers acceptable for formal business letters.

Fully-formed-character printers, covered in Chapter 6, produce characters similar to those produced by a typewriter. Although the mechanism may be different, as in the Apple LaserWriter and the Hewlett-Packard Laser Jet printer, the appearance of the characters is the familiar, solid form produced by standard typewriters.

CHARACTERS

The standard pitch for a printer is 10 characters per inch (*CPI*). Some printers have control codes that allow you to change this pitch to suit your needs.

Most printers have a standard set of 96 ASCII characters, which contains the letters of the alphabet, numbers, punctuation marks, and symbols. Some printers feature additional character sets for italic characters, block-graphic characters, scientific characters, and foreign-language characters. Proportional character sets space characters based on their size. Since *I* is smaller than *M*, it takes up less space.

RIBBONS

Printers will use a cloth ribbon or a mylar ribbon. They come in cartridges or on standard typewriter spools. The cloth ribbon can be used until it needs to be replaced or re-inked. The mylar or carbon ribbon can only be used once, and though the print quality is better with the mylar ribbon, it is more expensive to use and not practical for draft copies.

PAPER

The type of paper you use will depend on the type of printer and its capacity for handling paper. Thermal printers can only use thermal paper, which is chemically treated and is heat-sensitive. If your printer has pin feed, you may use *sprocket paper*, paper with holes on the sides, which comes in rolls or fanfolded. Single sheets or rolls of paper are used with friction-feed printers, which accept the paper just like a typewriter. Since there are different qualities of paper, use lightweight paper for your drafts and heavier paper for final presentations. For important printouts, "perforationless" fanfold paper can be purchased at a substantially higher price than normal printer paper. It combines the ease of fanfold paper with the smooth edges of single sheets. This paper is sometimes called *laser-cut* paper. If you are producing graphics for presentation, you might wish to use an artist's matte finish paper. Drawings produced by MacPaint and MacDraw are given a particularly good appearance by this type of paper.

BUFFER

The *buffer* is a storage area consisting of RAM (random access memory) chips. The amount of storage space depends on the printer and its capacity. The buffer stores each character sequentially, as sent by the computer, and allows the computer to continue operating while the printer is printing at its slower pace, thus saving time.

A buffer can be built into the printer or added to the system as a separate component. Another possibility is to use part of the Macintosh's RAM to act as a printer buffer. This choice requires special software but no special hardware.

INTERFACES

Computers use an interface to connect to the printer, allowing the printer to use a particular standard. These standards will allow you to connect almost any computer to any printer, and specify how to transfer information, as well as the type of cable and plug needed for connection.

The most common data format used in the industry for character and command representation is *ASCII*, the American Standard Code for Information Interchange. The two hardware standards are the RS-232C, a serial format transmission, and the Centronics-type, a parallel transmission.

Standards are used for the "handshaking" signals and for formatting the transmitted data, the *protocol*. In order for two machines made by different manufacturers to work together, they must have the same protocol.

The RS-232C designates the specific voltage levels, the required driver, and the receiver characters for 21 circuits. Information moves sequentially, bit by bit, between the computer and the printer, making it typically slower than a parallel interface. The connection involves up to 25 different wires, each having a defined use, although not all 25 are needed. With this particular standard, some of the parameters, such as baud rate, must be set by the software.

The parallel Centronics-type interface uses 36 different wires that send 8-bit bytes of information simultaneously. It is much quicker than the serial interface. The other wires are used for the handshaking signals. Centronics is a printer manufacturer and was an early user of the parallel transmission; hence, its name has been given to the protocol.

The Macintosh will require an appropriate connecting cable and a serial-to-parallel converter if the printer uses a parallel interface. Only an appropriate cable is required for a serial printer.

FUNCTION AND USE

The printer accepts electrical charges sent by the computer in the form of binary numbers, which represent the keyboard characters and some commands. These electrical charges are then translated into understandable print.

In addition to characters, a printer must translate commands such as print modes (normal, condensed, enlarged, double-strike), print functions (underline, superscript, subscript), print action (carriage return, line feed, vertical tab), and paper formatting (line spacing, form length, margins). These functions use an assigned number,

or in some cases two numbers, called an *escape sequence* to identify them to the printer. These escape sequences are not universal and you must check your printer manual for each particular function.

SETTING UP A WORD PROCESSOR

An alternate way of establishing contact between the computer and the printer is through a word processor, which addresses the printer. There is a variety of commercially available word processing software from which you can choose.

The first step is to configure your word processor to the printer. The program may ask you the type of printer you are using. In some cases you will be presented with a list of commonly used printers from which to choose. Other programs have a list of printer variables that you will have to manually define. After you have answered these questions, the program takes over and initiates the routines needed by the computer.

Characters are typed on the keyboard and presented on the screen for editing. When the work is complete, a simple one-letter command will print the material. In some cases features like emphasizing or underlining will require special handling and use of the function keys from the keyboard. The printed output will go to the printer you specified when you configured the word processor.

DOT-MATRIX PRINTERS

The dot-matrix printer forms characters by using a pattern of dots. This pattern is called the *matrix*, and the dots are made in a variety of ways. For instance, with an impact printer, a column of tiny hammers strikes the ribbon to form the character. Only those hammers needed to form the character actually strike the ribbon. With ink-jet printers, the ink is literally sprayed onto the paper through a configuration of channels. These are quiet, fast, and can more easily use colors. Thermal printers use heat to darken specially treated paper. Because there is no impact made with thermal printers, they are much quieter; however, the thermal paper is expensive. The laser printer burns the characters into the paper; this represents the state of the art and is very expensive. Line printers are extremely fast, printing an entire line at one time. Complete sets of characters are contained on bands or rotating drums that pass above the paper. Each column has an independent hammer that strikes the paper, which in turn strikes the character in front.

Impact dot-matrix and thermal printers form the characters progressively, rather than all at once, and the quality of the character depends upon the size of the matrix. Most printers will use a matrix of 9 dots across and 9 dots down (9 × 9), although a larger matrix (10 × 10, 12 × 12, or 14 × 14) is available with some models. The size and style of the characters can be altered through software control. When the matrix size is smaller than 8 × 8, you start losing quality, and the lower portion of characters with descenders are squeezed above the line instead of below.

Some dot-matrix printers improve the print quality with additional modes of operation. In the *emphasized mode*, characters are printed once and then again slightly to the side, filling in the spaces between the first set of dots to emphasize the character. In the *overstrike mode*, characters are also printed twice, a line at a time.

Both of these modes slow down the printer.

A few of the dot-matrix printers we reviewed feature a *correspondence mode*, which is an attempt to create letter-quality printing using dots. Again, it is slower than the standard mode.

Printer speed can be very important for some applications. The fastest dot-matrix printers are in the range of 400 to 300 characters per second (cps) in the standard mode, which is extremely fast compared to the much slower fully-formed-character printers. When using some of the modes, however, this speed is reduced by almost half.

Another factor in determining speed is whether the print head moves bidirectionally or unidirectionally. Bidirectional printing is much faster because printing starts from the left margin, goes to the right margin, and from there prints back to the left margin.

Dot-matrix printers are capable of producing graphic images with the curves and lines formed with the dots. Using a high-resolution mode, even more graphics can be created. Most of the printers we reviewed will create graphs and charts, which are useful in reports and other presentations.

Delta 10 and Delta 15

10—$449.00
15—$599.00

Star Micronics, Inc.

RATINGS

B	Overall rating
A	Price/performance
B	Software compatibility
B	Ease of installation
A	Documentation
B	Vendor support

FEATURES

Type:	Impact
Matrix size:	9 × 9
Descenders:	+
Speed:	160 cps
Bidirectional:	+
Logic-seeking:	+
Correspondence:	
Speed:	–
Matrix size:	–
Dot graphics:	240 × 144 dpi
Print:	
Expanded:	+
Compressed:	+
Emphasized:	+
Centronics parallel:	+
Serial:	+
Friction feed:	+
Pin feed:	+
Characters per line:	
10:	80, 96, 136
15:	136, 164, 232
Paper size:	10″-15″
Paper type:	Standard

PRODUCT SUMMARY

The Delta 10 and Delta 15 (15 1/2-inch carriage) are bidirectional, high-speed, dot-matrix printers. They are considered Epson-compatible. Both models are logic-seeking and represent Star Micronics' attempt to compete with the Epson FX-80 and FX-100 printers. Unless otherwise noted, this review will deal specifically with the Delta 10 model. Rolls and single sheets of paper are inserted from the back and use the standard friction feed or tractor feed for the sprocket paper. The Delta 15 has an option for paper to be fed from the bottom.

FEATURES FOR WORD PROCESSING

The Delta 10 uses a 9- × -9 matrix. Character sets include the 96 standard ASCII characters, 64 special characters, and 88 international characters for foreign-language applications. Other features include a selection of fonts, (standard, italic, or foreign-language characters), a selection of print pitches (pica, elite, condensed, or enlarged) and special print functions (superscript, subscript, underline, and double-strike). An 8K buffer is available for downloading 96 special characters for any applications you may have.

FEATURES FOR GRAPHICS

High-resolution graphics are created by sending bit-mapped pictures through software. A variety of modes and densities are available: 60 × 72 low resolution, 120 × 44 high resolution, or 240 × 144 ultrahigh resolution. For creating block graphics, 32 graphic characters are also available.

INSTALLATION AND INTERFACING

Installation is relatively easy. The manufacturer has provided clear instructions, which are both informative and understandable. The Delta 10 provides both serial (RS-232C) and standard parallel (Centronics-type) interface connectors. The serial version of this printer is preferred for use with the Macintosh. If the parallel version is used, a serial-to-parallel converter must be installed between the Macintosh and the printer to allow the signals sent by the Macintosh to be understood and executed by the printer. A printer driver must be installed in the System folder of any application being used by the Macintosh with this printer. A product called The Print-Link sold by GDT Software, Inc., includes a driver that will allow this printer to be used.

QUALITY AND PERFORMANCE

The Delta 10 provides high-speed and very good quality text. It also has an excellent capacity for graphics.

VENDOR SUPPORT

There is a 1-year warranty on parts and labor. Technical support from local dealers is available.

FX-80+ and FX-100+

FX-80+—$569.00
FX-100+—$849.00

Epson America, Inc.

RATINGS

A Overall rating
B Price/performance
A Software compatibility
A Ease of installation
A Documentation
C Vendor support

FEATURES

Type:	Impact
Matrix size:	11 × 9
Descenders:	+
Speed:	160 cps
Bidirectional:	+
Logic-seeking:	+
Correspondence:	
Speed:	–
Matrix size:	–
PET graphics:	–
Dot graphics:	240 × 144
Print:	
Expanded:	+
Compressed:	+
Emphasized:	+
Centronics parallel:	+
Serial:	–
Friction feed:	+
Pin feed:	+
Characters per line:	
FX-80:	80, 132
FX-100:	136, 233
Paper size:	8"-14"
Paper type:	Standard

PRODUCT SUMMARY

These printers are Epson's top-of-the-line and state-of-the-art printers. They are 80-column in normal mode, bidirectional, and logic seeking. A "quiet" mode for the office environment is on the market. An optional 15-inch-wide carriage (Model FX-100) allows you to use 14-inch paper. The Epson printers are well known for their print quality and graphics capabilities. The Epson FX-80+ is illustrated in Fig. 5-1. An optional single-sheet feeder may be installed on it.

FEATURES FOR WORD PROCESSING

For word-processing applications, the FX-80+ features an 11-×-9 matrix (character matrix is 5 × 7), 96 standard and italic ASCII characters, and nine international character sets. There is a 2K buffer area for storing a maximum of 255 characters for special applications. Reverse line feed and a proportional spacing mode are also featured.

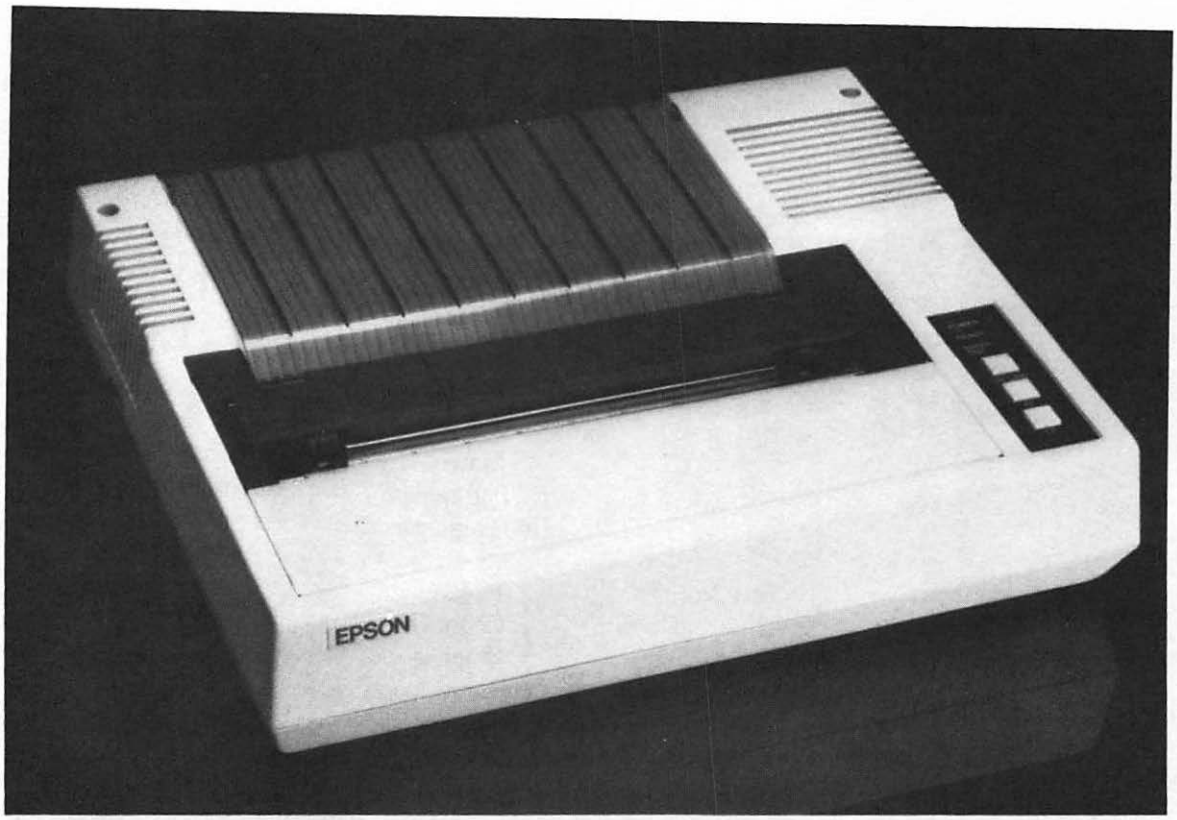

Fig. 5-1. The Epson FX-80+ Printer (courtesy Epson America Inc.).

Your program provides printer control codes and escape sequences, which allow you to select print modes, including normal, condensed, enlarged, and double-strike. You can select the print function such as underline, superscript, and subscript; the print action, which includes the carriage return, line feed and vertical tab; and finally the paper formatting, such as line spacing, form length, and page width.

FEATURES FOR GRAPHICS

There are two modes available. The 8-pin bit-image mode features a range of dot density from 480 dots per 8 inches (normal) to 1920 dots per 8 inches (quadruple). The 9-pin bit-image mode features two dot densities, normal and dual, which is 960 dots per 8 inches. The brightness of the dots may be controlled by changing the dot densities within a picture. No graphics characters for block graphics are provided, since it is recommended that you use the RAM for this data. Both versions of this printer now have a one-to-one graphics ratio feature that allows the printer to produce proportioned graphics such as round circles.

INSTALLATION AND INTERFACING

A Centronics interface is standard; the RS-232C serial interface is optional. The

serial interface is the preferred interface for use with the Macintosh. If the parallel interface version of the printer is being used, a serial-to-parallel converter must be installed between the computer and the printer.

Special printer driver programs must be installed in the System folder of those disks used by Macintosh applications that will be using these printers. Several disks that contain these drivers are available. One such product is called the Epson Macintosh Connection, sold by Assimilation Inc. Another such product is Epstart, sold by SoftStyle.

If you already own a parallel version of one of these printers, you may wish to convert the printer to allow it to operate as a serial printer and to emulate an ImageWriter. Two products are available to accomplish this conversion. The first such product is a serial interface board that may be installed in the printer. This interface is sold by HanZon. Another serial interface board is one called All You Need, from Dresselhaus. These products are described in Chapter 7.

QUALITY AND PERFORMANCE

An Epson printer is an excellent investment by virtue of its outstanding graphics and print quality. All the characters are well-formed. A feature on this printer allows you to tear off a page 1 inch from the last print position, reducing the waste of having to move the paper up a few inches before tearing it off. Still another feature eliminates the struggle to install the tractor unit when you want to use fanfold paper. This is done by a preinstalled pin-feed mechanism. The printer is noticeably quieter than other dot-matrix printers.

VENDOR SUPPORT

These printers are known for their durability, and our experience with them has proven this feature. There is a 90-day warranty on parts and labor. Service and breakdown problems are usually handled by authorized dealers, who are trained to handle them.

Gemini 10X and 15X

10X—$399.00
15X—$549.00

Star Micronics, Inc.

RATINGS		FEATURES	
B	Overall rating	Type:	Impact
A	Price/performance	Matrix size:	9 × 9
B	Software compatibility	Descenders:	+
B	Ease of installation	Speed:	120 cps
A	Documentation	Bidirectional:	+
B	Vendor support	Logic-seeking:	+
		Correspondence:	
		Speed:	–
		Matrix size:	–

FEATURES

Dot graphics:	240 x 144 dpi
Print:	
Expanded:	+
Compressed:	+
Emphasized:	+
Centronics parallel:	+
Serial:	–
Friction feed:	+
Pin feed:	+
Characters per line:	
10X:	80, 96, 136
15X:	136, 164, 232
Paper size:	8″-15″
Paper type:	Roll or sheets

PRODUCT SUMMARY

These two products have become very popular because of their low price, as well as their excellent quality. The only difference between these two models is the size of the carriage. The Gemini 15X offers a 15 1/2-inch carriage for 136-column printouts at 10 cpi.

They are bidirectional and logic seeking. Single sheets or rolls of paper use friction feed. Sprocket paper fed through the back uses the tractor feed. The 15X has the bottom-feed capability. There is an 816-byte buffer, which can be expanded to 4K or 8K with RAM chips supplied by Star Micronics. The Gemini printers are Epson-compatible for graphics. This review will refer to the Gemini 10X unless specifically noted otherwise.

FEATURES FOR WORD PROCESSING

For word-processing applications, the Gemini 10X features a 9-x-9 matrix, 96 standard and italic ASCII characters, 64 special characters, and 88 international characters for foreign-language applications. There are 96 special characters in any application you may create.

Your program provides printer control codes and escape sequences to select print modes, including normal, condensed, enlarged, and double-strike. You can select print functions, such as underline, superscript, and subscript; print action which includes the carriage return, line feed, and vertical tab; and the paper formatting, such as line spacing, form length, and page width.

FEATURES FOR GRAPHICS

High-resolution graphics are created by sending bit-mapped pictures through your software. There are a number of graphics modes, depending on your applications. Low-resolution dot density is 60 x 72; high-resolution dot density is 120 x 144, and ultrahigh dot density resolution is 240 x 144. Block graphics are created with 32 graphic characters.

INSTALLATION AND INTERFACING

The Gemini 10X uses a standard parallel (Centronic-type) interface and is easy to install. A serial-to-parallel converter must be installed between the Macintosh and the printer when either of these printers is used. Printer drivers must be installed in the System folder of any disk containing applications that will use these printers. The Print-Link contains drivers for these printers. The later models include informative and easy-to-understand instructions.

QUALITY AND PERFORMANCE

There were a few items we discovered when we tested this printer. When you begin to print, the first character is not printed clearly because of some type of timing problem, and this problem occurred regularly. The next item is that the friction feed mechanism does not work well with fanfold paper. The paper starts wandering toward the right margin. When you are printing over 10 pages, the tractor feed must be used and must be exactly aligned and adjusted for paper tension or the paper will tear or jam.

The Gemini 10X is a good investment, producing very high-quality text and excellent graphics.

VENDOR SUPPORT

There is a 1-year warranty on parts and labor. Technical support is provided by local dealers.

ImageWriter

10″ carriage—$595.00
15″ carriage—$749.00

Apple Computer, Inc.

RATINGS		FEATURES	
A	Overall rating	Type:	Impact
B	Price/performance	Matrix size:	7 × 9
A	Software compatibility	Descenders:	+
A	Ease of installation	Speed:	120 cps
A	Documentation	Bidirectional:	+
B	Vendor support	Logic-seeking:	+
		Correspondence:	
		Speed:	120
		Matrix size:	12 × 18
		Dot graphics:	160 dpi
		Print:	
		Expanded:	+
		Compressed:	+
		Emphasized:	+
		Centronics parallel:	–
		Serial:	+

FEATURES	
Friction feed:	+
Pin feed:	+
Characters per line:	136 (10″)
Paper size:	10″ or 15″
Paper type:	Standard

PRODUCT SUMMARY

The Apple ImageWriter printer is a serial, dot-matrix printer. It prints text at 120 characters per second, bidirectionally and with logic-seeking head placement.

The ImageWriter comes in two sizes. A standard model has a 10-inch-wide carriage, while the ImageWriter 15-inch model has a 15-inch-wide carriage. It will handle both friction feed and continuous-feed paper. The adjustable sprockets can handle paper from 4 1/2 inches to the width of the carriage. (See Figs. 5-2 and 5-3.)

FEATURES FOR WORD PROCESSING

The ImageWriter has a variety of pitches, including 10, 12, and 16.5. There

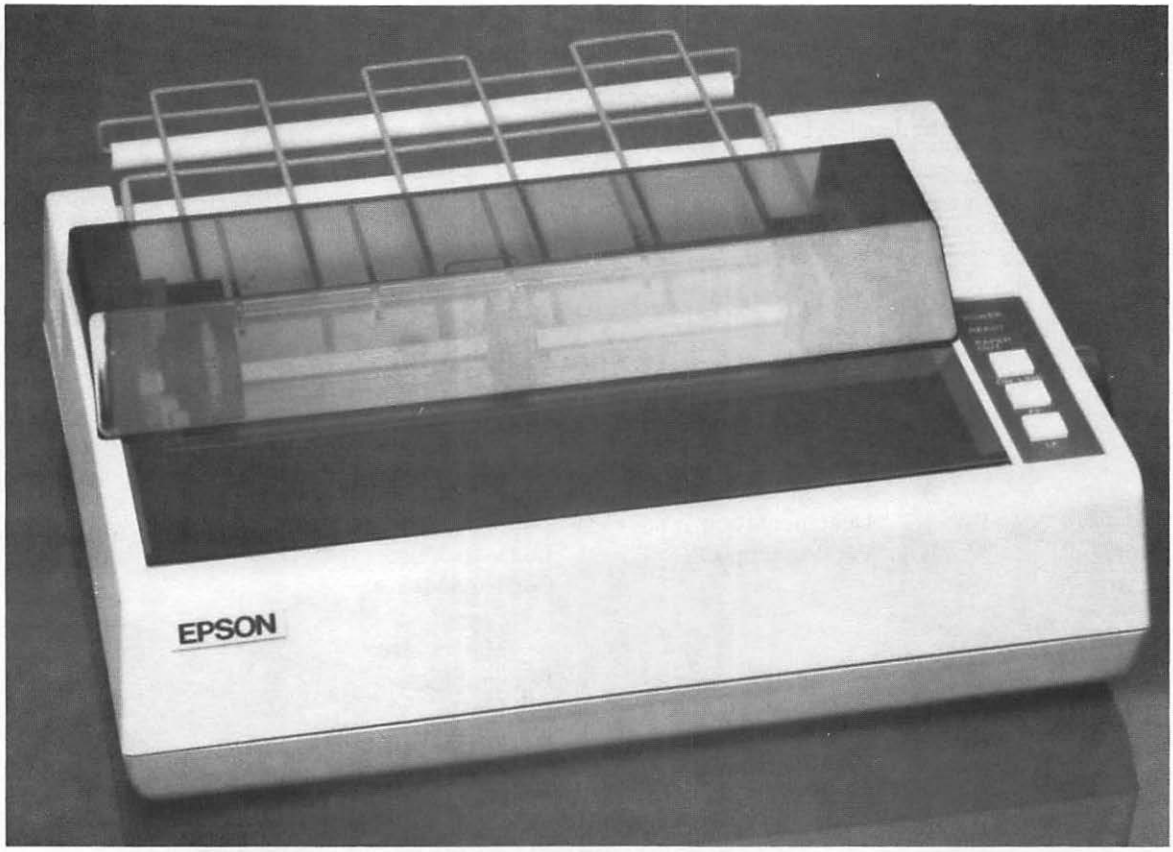

Fig. 5-2. The Epson RS-80+ Printer (courtesy Epson America Inc.).

are seven different character styles and eight different sizes, including proportional spacing. You can also create custom character sets and download them into the memory of the printer. It works with all Macintosh word-processing software. It is the standard text-printing device for much software distributed by Apple Computer, including the MacWrite and MacPaint programs.

FEATURES FOR GRAPHICS

Graphics are built into the ImageWriter. It can achieve a resolution of 160 dots per square inch across by 144 dots per square inch down. The ImageWriter is the standard graphics printing device specified by much of the software distributed by Apple Computer, Inc.

INSTALLATION AND INTERFACING

The ImageWriter comes with a standard RS-232C serial interface and with appropriate cables for connecting it to a Macintosh.

QUALITY AND PERFORMANCE

The ImageWriter is a high-quality printer. It functions quite silently for an impact dot-matrix printer. Its text output is nearly indistinguishable from fully-formed-character printers and offers the flexibility of multiple character sizes and fonts lacking in most fully-formed-character printers. The ease of interfacing the printer to many standard Macintosh programs adds to its appeal. Because of its handling of graphics, the ImageWriter is the printer of choice for the Macintosh, which produces graphics output for a printer in word processing and many other applications.

VENDOR SUPPORT

The ImageWriter comes with a 90-day warranty. Service is available at Apple's extensive dealer service network.

LQ-1500

$1395.00

Epson America, Inc.

RATINGS		FEATURES	
A	Overall rating	Type:	Impact
B	Price/performance	Matrix size:	9 × 17
A	Software compatibility	Descenders:	+
A	Ease of installation	Speed:	200 cps
A	Documentation	Bidirectional:	+
A	Vendor support	Logic-seeking:	+
		Correspondence:	
		Speed:	67 cps
		Matrix size:	37 × 17

FEATURES	
Dot graphics:	+
Print:	
Expanded:	+
Compressed:	+
Emphasized:	+
Centronics parallel:	+
Serial:	–
Friction feed:	+
Pin feed:	–
Characters per line:	136
Paper size:	to 16″ wide
Paper type:	Standard

PRODUCT SUMMARY

The LQ-1500 is a high-speed new printer from Epson offering many features. It is the only dot-matrix printer in this price range that produces a correspondence-quality print that is acceptable for letter-quality documents. It is bidirectional and logic seeking. There is a 2K buffer for storage. Friction feed is standard and an adjustable tractor is optional.

FEATURES FOR WORD PROCESSING

For word-processing applications there is a 9-×-17 matrix, which expands to 37 × 17. This printer uses the standard 96 ASCII character set and includes 32 international characters and 96 italic characters. Features include 128 downloadable characters; vertical and horizontal incremental motion; proportional spacing; expanded, compressed, and emphasized print; double-strike; underlining; superscripts and subscripts, and automatic skip-over perforation. An automatic single-sheet paper guide saves you from having to feed sheets in one at a time. The near-letter-quality mode is very fast and the print is very good.

FEATURES FOR GRAPHICS

Block-graphic characters are not available; however, dot graphics are produced with 10 different bit-image modes. The graphics matrix is variable in dot density.

INSTALLATION AND INTERFACING

A Centronics-type parallel interface is standard. RS-232C serial and IEEE-488 serial interfaces are optional. If the parallel version of this printer is employed with the Macintosh, a serial-to-parallel converter must be installed between the printer and the computer. Printer drivers must be installed in the System folder of any disk containing an application that will be using this printer. Such drivers are available in a product called The Print-Link.

QUALITY AND PERFORMANCE

The correspondence mode allows you to print excellent near-letter-quality material.

VENDOR SUPPORT

There is a 1-year warranty. Technical support is available from authorized dealers trained to handle your problems.

RX-80+, RX-80FT, and RX-100+

Epson America, Inc.

RX-80+—$369.00
RX-80FT—$369.00
RX-100+—$699.00

RATINGS		FEATURES	
A	Overall rating	Type:	Impact
A	Price/performance	Matrix size:	9 x 9
B	Software compatibility	Descenders:	+
A	Ease of installation	Speed:	100 cps
A	Documentation	Bidirectional:	+
C	Vendor support	Logic-seeking:	+
		Correspondence:	
		Speed:	–
		Matrix size:	–
		Dot graphics:	240 x 144
		Print:	
		Expanded:	+
		Compressed:	+
		Emphasized:	+
		Centronics parallel:	+
		Serial:	+
		Friction feed:	+ (FT only)
		Pin feed:	+
		Characters per line:	80, 132
		Paper size:	10″
			15″ (FT only)
		Paper type:	Standard

PRODUCT SUMMARY

This is a low-cost, 80-column printer that is bidirectional and logic seeking. There is also a quiet mode at 50 cps for office environments. Friction feed is optional on the RX-80+ (Fig. 5-2), and a wide carriage (14-inch-wide paper) is available on the RX-100+. The printer also features a tear bar for tearing off paper 1 inch below the print line to save paper. The FT version has enhanced graphics capability.

FEATURES FOR WORD PROCESSING

For word-processing applications, the RX-80+ features a 9-×-9 matrix (character matrix 5 × 7), 96 standard and italic ASCII characters, and 11 international characters for use in foreign-language applications.

Using the printer control codes and escape sequences you can select the print modes (normal, condensed, emphasize, enlarged, double-strike), the print functions (underline, subscript, superscript), the print action (carriage return, line feed, vertical tab) and the paper format (line spacing, form length, page width).

FEATURES FOR GRAPHICS

Epson printers with the FT option are known for their fine graphics. There are 32 graphics symbols for creating block graphics, accessed through control codes. These symbols are compatible with the Epson HX-20 computer's graphics. You may select from a variety of dot densities: 480 dots per 8 inches, 960 dots per 8 inches, or 1920 dots per 8 inches.

The RX-80+ also features a hex dump mode, where data sent from the computer is printed in hexadecimal notation.

INSTALLATION AND INTERFACING

Due to its wide popularity, the Epson printers are easily interfaced with a variety of computers. The Centronics parallel interface is standard on these printers. A serial interface is optional. If the parallel interface version of these printers is used with the Macintosh, a serial-to-parallel converter must be installed between the printer and the computer. Special drivers such as Epstart and the Macintosh Epson Connection must beinstalled in the System folder on any disks containing applications that will be using these printers.

QUALITY AND PERFORMANCE

These printers offer excellent print quality and graphics resolution. The characters appear well-formed, and the printer is quieter compared to similar printers. The tear bar is a convenient feature which also saves wasted paper.

VENDOR SUPPORT

There is a 90-day warranty on parts and labor. Technical support is available from authorized dealers trained to handle these problems.

TTXpress

$229.00

Teletex Communication Corp.

RATINGS		FEATURES	
A	Overall rating	Type:	Thermal
A	Price/performance	Matrix size:	7 × 9

RATINGS		FEATURES	
B	Software compatibility	Descenders:	+
A	Ease of installation	Speed:	50 cps
C	Documentation	Bidirectional:	–
B	Vendor support	Logic-seeking:	–
		Correspondence:	
		Speed:	–
		Matrix size:	–
		Dot graphics:	+
		Print:	
		Expanded:	+
		Compressed:	+
		Emphasized:	+
		Centronics parallel:	+
		Serial:	–
		Friction feed:	+
		Pin feed:	–
		Characters per line:	80/160
		Paper size:	8 1/2"
		Paper type:	Thermal

PRODUCT SUMMARY

The TTXpress is a truly unique thermal dot-matrix printer. It weighs only 2 pounds and will print for 2 hours on its batteries. The TTXpress offers a Centronics parallel interface, friction feed of single sheets, and bidirectional paper feeding for graphics. It even has a 2K buffer, which is extraordinary in its price range.

FEATURES FOR WORD PROCESSING

The TTXpress offers the most commonly used word processing features: descenders, compressed print, enlarged print, emphasized print, and underlining. These features will work with most software and parallel interfaces.

FEATURES FOR GRAPHICS

The TTXpress has full graphics capability at 72 dots per inch.

INSTALLATION AND INTERFACING

The TTXpress requires a standard Centronics parallel interface. If this printer is used with the Macintosh, a serial-to-parallel converter must be installed between the Macintosh and the printer. Special driver programs, such as those contained on The Print-link, must be installed in the system folder of any disk containing a Macintosh application that will be using this printer.

QUALITY AND PERFORMANCE

The TTXpress is well made and provides a surprisingly good-quality printout.

If portability is a major factor in your printer selection, this may well be the printer for you.

VENDOR SUPPORT

There is a 30-day warranty on parts and labor. Technical support is available.

WORKSHEET FOR DOT-MATRIX PRINTERS

Product $.

Manufacturer

RATINGS

Overall rating
Price/performance
Software compatibility
Ease of installation
Documentation
Vendor support

FEATURES

Type:
Matrix size:
Descenders:
Speed:
Bidirectional:
Logic-seeking:
Correspondence:
  Speed:
  Matrix size:
Dot graphics:
Print:
  Expanded:
  Compressed:
  Emphasized:
Centronics parallel:
Serial:
Friction feed:
Pin feed:
Characters per line:
Paper size:
Paper type:

PRODUCT SUMMARY

FEATURES FOR WORD PROCESSING

FEATURES FOR GRAPHICS

INSTALLATION AND INTERFACING

QUALITY AND PERFORMANCE

VENDOR SUPPORT

Table 5-1. Comparative Ratings for Dot-Matrix Printers.

Printer	Price	Ratings					
		1	2	3	4	5	6
Delta 10	$449.00	B	A	B	B	A	B
Delta 15	599.00	B	A	B	B	A	B
FX-80+	569.00	A	B	A	A	A	C
FX-100+	849.00	A	B	A	A	A	C
Gemini 10X	399.00	B	A	B	B	A	B
Gemini 15X	549.00	B	A	B	B	A	B
ImageWriter (10" carriage)	595.00	A	B	A	A	A	B
ImageWriter (15" carriage)	749.00	A	B	A	A	A	B
LQ-1500	1395.00	A	B	A	A	A	A
RX-80+	369.00	A	A	B	A	A	C
RX-80FT	369.00	A	A	B	A	A	C
RX-100+	699.00	A	A	B	A	A	C
TTXpress	229.00	A	A	B	A	C	B

Key to Ratings

1—Overall rating
2—Price/performance
3—Software compatibility
4—Ease of installation
5—Documentation
6—Vendor support

Table 5-2. Comparative Features for Dot-Matrix Printers.

Printer	Features								
	1	2	3	4	5	6	7	8	9
Delta 10	I	9×9	+	160	+	+	–	–	240×144
Delta 15	I	9×9	+	160	+	+	–	–	240×144
FX-80+	I	11×9	+	160	+	+	–	–	240×144
FX-100+	I	9×11	+	160	+	+	–	–	240×144
Gemini 10X	I	9×9	+	120	+	+	–	–	240×144
Gemini 15X	I	9×9	+	120	+	+	–	–	240×144
ImageWriter	I	7×9	+	120	+	+	120	12×18	160
LQ-1500	I	9×17	+	200	+	+	67	37×17	+
RX-80+	I	9×9	+	100	+	+	–	–	240×144
RX-80 FT	I	9×9	+	120	+	+	–	–	240×144
RX-100+	I	9×9	+	120	+	+	–	–	240×144
TTXpress	T	7×9	+	50	–	–	–	–	72

Printer	Features									
	10	11	12	13	14	15	16	17	18	19
Delta 10	+	+	+	+	+	+	+	80	10	S
Delta 15	+	+	+	+	+	+	+	80	10	S
FX-80+	+	+	+	+	–	+	+	80	8	S
FX-100+	+	+	+	+	–	+	+	136	15	S
Gemini 10X	+	+	+	+	+	+	+	80	8	S
Gemini 15X	+	+	+	+	+	+	+	80	8	S
ImageWriter	+	+	+	–	+	+	+	136	10	S
LQ-1500	+	+	+	+	+	+	+	136	16	S
RX-80+	+	+	+	+	+	–	+	80	10	S
RX-80 FT	+	+	+	+	+	+	+	80	11	S
RX-100+	+	+	+	+	+	+	+	80	11	S
TTXpress	+	+	+	+	–	+	–	80	8	T

Key to Features

1—Type (T = Thermal, I = Impact, J = Ink Jet)
2—Matrix size (width × height)
3—Descenders
4—Speed (characters per second)
5—Bidirectional
6—Logic seeking
7—Correspondence speed (characters per second)
8—Correspondence matrix size (width × height)
9—Dot graphics (dots per inch/+ equals variable)
10—Expanded print
11—Compressed print
12—Emphasized print
13—Centronics parallel
14—Serial
15—Friction feed
16—Pin feed
17—Characters per line
18—Paper size (inches)
19—Paper size (S = Standard, T = Special thermal)

Chapter 6

Fully-Formed-Character Printers

Fully-formed-character printers are used for correspondence and in situations where the quality of the output generated by the printer is more important than its speed. The print speed is generally much slower than a dot-matrix printer because of the more complex mechanical motions typically used to create fully formed characters. The characters are fixed, unlike for dot-matrix printers. A fully-formed-character printer works in much the same way as an electric typewriter. The laser printer, of course, produces characters in a totally different way, but it is still a fully-formed-character printer. Characters and graphics are projected onto a rotating photosensitive drum. The area made up by the character or graphic is then filled magnetically with toner that is then transferred to bond paper, plastic, or any similar medium by a combination of heat and pressure.

DAISY-WHEEL PRINTERS

Some of our reviews will cover *daisy-wheel printers*. In these printers, the characters are fixed on a wheel resembling a daisy. The wheel moves horizontally across the page, rotates until the desired character is lined up, and strikes it against an inked ribbon. The wheels are removable and allow you to change the style of the print easily. Some printers offer more of a variety of print styles than others and our reviews will note this fact.

Print speeds range from 12 to 50 cps, depending on price and features. Another feature of a daisy-wheel printer is a *buffer*, which holds data from the computer for input to the printer when needed. A sheet feeder allows you to automatically feed

single sheets of paper to the printer, rather than one at a time. In some cases a keyboard attachment can be used as a regular typewriter.

For word processing there are even more features available, including special print effects (boldface, shadow print, full line and word underline, superscript, and subscript), print functions (line space, carriage return, form feed, backspace) and a variety of character pitches (10, 12, or 15 cpi), automatic proportional spacing, double-strike mode, and forward and backward print modes. Some of these are accessible from switches on the front panel, from printer control codes and escape sequences sent to the printer by a program, or from the DIP switches inside the printer case.

The graphics mode is limited on these printers, but does allow you to create graphs and charts through your program or by using the plot mode on some models.

Some models use friction feed paper similar to a typewriter. Others use a continuous roll of paper, which may tend to creep over to one edge after a few pages. A good-quality printer will offer both options. A tractor feed is optional in some cases.

OTHER TYPES OF FULLY-FORMED-CHARACTER PRINTERS

The daisy-wheel printer was one of the early and most successful types of fully-formed-character printers. Some years ago the daisy-wheel printer was essentially a synonym for fully-formed-character printers; however, there are a number of other types of printers which produce fully formed characters.

One of the simplest alternatives to the daisy-wheel is the standard electric typewriter. A number of companies have produced typewriters that function exactly like electric typewriters which have one arm for every letter with the element at the end. These then interface with the computer and act as a fully-formed-character printer. In some cases these printers have a keyboard and can also be used as an electric typewriter.

Another type of fully-formed-character printer uses a device shaped somewhat like a small spool or thimble. They are known as *thimble printers*, and except for the shape of the device that bears the type, they function identically to a daisy-wheel printer.

The *ball printer* functions in the same way as the IBM Selectric typewriter. Instead of using a daisy-wheel or a thimble, the type for the characters is contained on the ball, which rotates and twists to bring the appropriate letter into contact with the ribbon and the paper.

Fully formed characters can also be produced by an *ink-jet printer*. While most ink-jet printers produce dot-matrix characters, there are some on the market that produce fully formed characters.

Finally, fully formed characters can be produced by a laser. The Hewlett-Packard Laserjet was the outstanding example in this field until the Apple LaserWriter printer was introduced in 1985. In this case since the fully formed characters are produced by an electrical and optical system rather than by precast mechanical representations of the letters, the same printer is also capable of producing a variety of fonts. In this way, you can use several sizes of type or italics without the awkwardness of changing a type wheel.

Fully-formed-character printers are often supplied with serial interfaces as stan-

dard. This interface is the standard for the Macintosh, which uses internal serial circuitry to communicate with external hardware devices such as printers. Printers are connected to the Macintosh with a nine-pin connector that is plugged into the printer port on the back panel of the computer. Special programs called printer drivers are required to ensure that the Macintosh properly uses fully-formed-character printers. Such drivers are readily available and are inexpensive. Some examples are ProPrint. The Mac Daisy-Wheel Connection, JetStart for the H-P Laserjet printer, Print-Link, and others.

The LaserWriter requires a special driver that can be installed in the System Folder. The LaserWriter uses the Macintosh's serial printer port or serial modem port, but makes use of the AppleTalk circuits and connectors, rather than a standard connector and cord.

Apple Daisy-Wheel Printer

$2195.00

Apple Computer, Inc.

RATINGS		FEATURES	
A	Overall rating	Type:	Daisy-wheel
C	Price/performance	Speed:	40 cps
B	Software compatibility	Bidirectional:	+
A	Ease of installation	Logic-seeking:	+
A	Documentation	Centronics parallel:	–
B	Vendor support	Serial:	+
		Friction feed:	+
		Pin feed:	+
		Characters per line:	198
		Paper size:	to 15″ wide

PRODUCT SUMMARY

The Apple Daisy-Wheel Printer is a high-quality, high-speed, daisy-wheel printer. It uses special Apple daisy wheels that contain 130 characters each. A tractor feed is available at an extra cost. A variety of the special 130-character print wheels are available, including Courier 10, Prestige 12, Gothic 15, and Executive.

FEATURES FOR WORD PROCESSING

The printer functions in 10 pitch, 12 pitch, 15 pitch, and proportional spacing. It has programmable hammer intensity and ribbon movement. It permits underlining as well as superscripts and subscripts. It also permits variable horizontal and vertical formatting and variable forms length.

FEATURES FOR GRAPHICS

There is a special, programmable graphics mode available with the printer.

INSTALLATION AND INTERFACING

The Apple Daisy-Wheel Printer comes with a serial interface. It can be connected to the Macintosh via the printer port on the back panel of the computer. A special driver program must be inserted in the System folder before the Macintosh can employ this printer. ProPrint and the Mac Daisy-Wheel Connection may be used to provide these drivers.

QUALITY AND PERFORMANCE

The Apple Daisy-Wheel Printer is an expensive printer. It is, however, a heavy-duty, extremely reliable, and high-quality machine.

VENDOR SUPPORT

The printer comes with Apple's standard 90-day warranty. Service is available through Apple's dealer service network.

CR-II

Comrex International, Inc.

Parallel—$599.00
Serial—$649.00

RATINGS		FEATURES	
A	Overall rating	Type:	Daisy-wheel
A	Price/performance	Speed:	12 cps
B	Software compatibility	Bidirectional:	+
A	Ease of installation	Logic-seeking:	+
B	Documentation	Centronics parallel:	+
B	Vendor support	Serial:	+
		Friction feed:	+
		Pin feed:	–
		Characters per line	110
		Paper size:	to 13.5″ wide

PRODUCT SUMMARY

This printer is low cost and bidirectional in the text mode. There is a standard 5K buffer so you can make multiple copies (it reprints the buffer) using the COPY switch. A large variety of print wheels are available. Tractor feed and sheet feed are options. With the optional keyboard this printer can be used as a typewriter. You can also use multicolor ribbons and correction tape.

FEATURES FOR WORD PROCESSING

For word-processing applications there are many features, such as automatic proportional spacing, shadow-print and double-strike modes, auto underline,

superscripts and subscripts, and programmable pitch, which also comes with a switch control. You can set the proportional spacing and print pitch from the front control panel.

FEATURES FOR GRAPHICS

You can overcome the limited graphics using the escape sequences for the plot mode, which allows you to move the print head. By controlling this movement and by printing the desired text or graphic characters, you can create very good charts and graphs.

INSTALLATION AND INTERFACING

You may get this printer with a parallel or serial port, depending on what you need. If the serial version of the printer is purchased, it may be connected directly to the Macintosh's printer port on the back panel of the computer, provided the proper connector plug and cable are used. If the parallel version is purchased, a serial-to-parallel converter of some type must be used. A special printer driver must be installed in the Macintosh System folder to allow the computer to communicate with this printer. Both ProPrint and the Print-Link may be used to install the proper driver.

QUALITY AND PERFORMANCE

The CR-II is a very good printer and uses the Brother print wheel. The buffer is small but very nice, since it is not standard on many printers. With the sheet feeder option you can automatically feed single sheets into the printer, rather than one at a time. The graphics may be limited, but any report would be enhanced with graphs and charts.

VENDOR SUPPORT

There is a limited 90-day warranty against defects in material and workmanship. Technical support is available from local dealers.

CR-III

Parallel—$995.00
Comrex International Inc. Serial—$1045.00

RATINGS		FEATURES	
A	Overall rating	Type:	Daisy-wheel
A	Price/performance	Speed:	23 cps
B	Software compatibility	Bidirectional:	+
B	Ease of installation	Logic-seeking:	+
B	Documentation	Centronics parallel:	+
B	Vendor support	Serial:	+
		Friction feed:	+

FEATURES	
Pin feed:	–
Characters per line:	132
Paper size:	to 14 7/8" wide

PRODUCT SUMMARY

This is the wide-carriage model from Comrex. It is bidirectional and logic seeking in the text mode, and is equipped with a 5K buffer to hold three to four pages. Multiple copies can be made by using the COPY switch to reprint the buffer contents. There is a large variety of print wheels available. There is an optional cut-sheet feeder and a tractor-feed mechanism, and an automatic paper-loading feature, to load single sheets at a specific position.

FEATURES FOR WORD PROCESSING

For word-processing applications, the CR-III has a wide range of features, including automatic proportional spacing, shadow-print and double-strike modes, automatic underlines, programmable pitch (available also with switch control), subscripts and superscripts. The front panel is used to set the proportional spacing and print pitch. Printer control codes select the print formatting features such as margins settings, vertical and horizontal spacing, and paper length. Use the DIP switches to select some features and specific foreign-language character sets. The CR-III comes with two-color ribbons for color printing.

FEATURES FOR GRAPHICS

This printer has limited graphics capabilities; however, by using the proper escape sequences you can select the plot mode to move the print head. This feature and the ability to print the desired text or graphics character can create very good graphics for charts and graphs.

INSTALLATION AND INTERFACING

The printer is available with a serial or parallel interface. It must be connected to the Macintosh via the 9-pin printer port on the back panel of the computer. If you choose the serial version, it may be connected directly to the Macintosh with a proper cable. If the printer is the parallel version, a serial-to-parallel converter is required. A special printer driver must be installed on the same disk as any software that will use this printer. Such drivers are available with Print-Link and ProPrint.

QUALITY AND PERFORMANCE

This is an excellent printer which uses the Brother print wheel. Although too small for extensive word processing, the buffer is a unique and useful feature. The sheet feeder option lets you automatically feed single sheets into the printer, rather than one by one. The graphics are limited but can enhance your documents with charts and graphs.

VENDOR SUPPORT

There is a limited 90-day warranty against defects in materials and workmanship. Technical support is available through local dealers.

Diablo 630 ECS

$2529.00

Diablo Systems Incorporated

RATINGS		FEATURES	
A	Overall rating	Type:	Daisy-wheel
A	Price/performance	Speed:	40 cps
A	Software compatibility	Bidirectional:	+
B	Ease of installation	Logic-seeking:	+
A	Documentation	Centronics parallel:	+
B	Vendor support	Serial:	–
		Friction feed:	+
		Pin feed:	–
		Characters per line:	132, 158, 198
		Paper size:	to 13.2″ wide

PRODUCT SUMMARY

The 630 ECS features a unique print wheel with 192 characters, plus the ability to construct 49 additional characters.

FEATURES FOR WORD PROCESSING

The Diablo 630 ECS has many text-formatting features, including: true proportional spacing, bold and shadow printing, superscripting, and subscripting. Of course, the extended character set is also included.

FEATURES FOR GRAPHICS

There are graphics, shading, and block-graphic modes available.

INSTALLATION AND INTERFACING

This printer must be connected to the Macintosh with a cable that has a 9-pin connector on one end and the proper connector for the printer on the other end. The 9-pin connector is plugged into the printer socket on the back panel of the Macintosh. If the printer is the serial version, the other end may be connected directly to the printer. If you are using the parallel version of the printer, it must be connected to the printer through a serial-to-parallel converter. Special printer drivers are required on the same disk as any software that will be using this printer. These drivers are available on the Mac Daisy-Wheel Connection disk, the Print-Link disk, and the ProPrint disk.

QUALITY AND PERFORMANCE

This has become an "industry standard." It is interesting to note that most other printer companies are bragging about their Diablo 630 emulation. This should tell you the importance of Diablo in the letter-quality market.

The company lives up to the claims. The 630 is an extremely durable, rugged printer. It is designed to take a lot of punishment.

VENDOR SUPPORT

Diablo offers a 1-year warranty on its printers.

DX-15

Serial or parallel—$499.00

Dynax, Inc.

RATINGS		FEATURES	
A	Overall rating	Type:	Daisy-wheel
A	Price/performance	Speed:	13 cps
B	Software compatibility	Bidirectional:	+
A	Ease of installation	Logic-seeking:	+
B	Documentation	Centronics parallel:	+
B	Vendor support	Serial:	+
		Friction feed:	+
		Pin feed:	–
		Characters per line:	110
		Paper size:	to 13.5" wide

PRODUCT SUMMARY

This popular low-cost model is loaded with special features. It is bidirectional and comes with a standard 3K buffer or an optional 5K buffer for holding text pages. This buffer enables you to print multiple copies using the COPY switch. Another option is a keyboard that can be used as a typewriter and costs $195. A large number of print wheels are available. The DX-15 is compatible with Diablo 630 software. There is an optional sheet feeder available for $250 and a tractor feed for $120.

FEATURES FOR WORD PROCESSING

This printer has a wide range of features which can be used in word-processing applications, including automatic proportional spacing, shadow printing, double striking, auto underlining, superscripting, and subscripting. Programmable pitch is also included. The front panel can be used to set the proportional spacing and the print pitch.

FEATURES FOR GRAPHICS

The DX-15 has limited graphics capabilities. With the appropriate options you

can initiate the plot mode, using proper escape sequences, allowing the print head to move around. You can create very good graphs and charts by controlling the movement and position of the print head and by printing the desired text or graphics character.

INSTALLATION AND INTERFACING

Most interfaces will work adequately in their individual word-processing modes. When you are given options on a printer set-up menu, select the Diablo option first. Otherwise, use the general parallel printer option.

This printer must be connected to the Macintosh via the printer port on the back panel of the computer. A 9-pin plug is required for the Macintosh end of the connection. If the printer is the serial version, it can be connected directly to the Macintosh. If it is a parallel printer, it must be connected to the Macintosh through a serial-to-parallel converter. A special printer driver is required on the same disk as any application that will use this printer.

QUALITY AND PERFORMANCE

This is an excellent low-cost printer. Because it uses the Brother print wheel, a wide selection of types is available. The buffer is a unique feature, although it is too small for any sophisticated applications. The sheet feeder option saves time and energy spent on feeding sheets one at a time. The graphics, although limited, would enhance any document with graphs and charts.

VENDOR SUPPORT

There is a 90-day warranty on parts and labor. Technical support is available from local dealers.

EXP-500

Serial or parallel—$549.00

Silver Reed Corp. of America

RATINGS		FEATURES	
B	Overall rating	Type:	Daisy-wheel
B	Price/performance	Speed:	16 cps
B	Software compatibility	Bidirectional:	+
A	Ease of installation	Logic-seeking:	+
B	Documentation	Centronics parallel:	+
B	Vendor support	Serial:	+
		Friction feed:	+
		Pin feed:	–
		Characters per line:	132
		Paper size:	to 13.2″ wide

PRODUCT SUMMARY

The EXP-500 is a bidirectional (in the line print mode), logic-seeking printer. It offers a serial mode for printing data as received from the computer, and a line print mode, where the received data is input into a buffer and printed one line at a time after a line feed, form feed, or carriage return. The modes are selected with the proper DIP switches. Friction feed is standard; however, a tractor feed unit is optional for $159.

FEATURES FOR WORD PROCESSING

For word-processing applications many useful features are available, including character pitch (10, 12, or 15 cpi). Using the printer control codes, you may select boldface, underline, subscript, and superscript for special effects. Using escape sequences you can access print motion control functions like line spacing, form feed, carriage return, and backspace. As long as you can send escape sequences through the program to access the special print functions, most word-processing programs will work with this printer.

FEATURES FOR GRAPHICS

The EXP-500 has limited graphics; however, using the proper escape sequences you can move the print head around. When you control the movement and position of the print head in this manner and print the desired text or graphics character, you can create very good graphs and charts. The manual describes how the vertical and horizontal motion index (HMI and VMI) can create graphic effects through your software.

INSTALLATION AND INTERFACING

This printer comes with a parallel or serial interface. Choose the serial interface for use with the Macintosh unless you wish to route the computer to printer signals through a serial-to-parallel converter. A special printer driver is required on the same disk as any Macintosh software that will be using this printer. These drivers are available on the Mac Daisy-Wheel Connection disk and on the Print-Link disk.

QUALITY AND PERFORMANCE

This is a good printer with a wide selection of print wheels for any application. The serial and line printer modes are useful and unique. Although graphics are limited, they can be used to create graphs and charts.

VENDOR SUPPORT

There is a 90-day warranty on parts and labor. Technical support is available through local dealers or an 800 number.

F-10 Printmaster

Parallel or serial—$1995.00

C. Itoh Digital Products

RATINGS	
B	Overall rating
A	Price/performance
B	Software compatibility
B	Ease of installation
B	Documentation
A	Vendor support

FEATURES	
Type:	Daisy-wheel
Speed:	55 cps
Bidirectional:	+
Logic-seeking:	+
Centronics parallel:	+
Serial:	+
Friction feed	+
Pin feed	–
Characters per line:	136
Paper size:	to 15″ wide

PRODUCT SUMMARY

This is a heavy-duty, fully-formed-character printer which features a very fast print speed and carriage return time. It is bidirectional and comes with a 256-character buffer; a 2K buffer is optional. It is fairly quiet, making it appropriate for office use. Also, the speed of 55 cps makes this an excellent choice for heavy usage.

FEATURES FOR WORD PROCESSING

The F10 Printmaster performs all of the basic word-processing functions. The paper-handling functions include friction feed, optional tractor feed ($325.00), optional cut-sheet feeder ($455.00), three-part form, and multistrike ribbon.

FEATURES FOR GRAPHICS

There are no features for graphics.

INSTALLATION AND INTERFACING

There are two different versions of the Printmaster, a parallel and a serial. Choose the serial printer for use with the Macintosh. If you already have the parallel version of this printer, you must connect it to the Macintosh through a serial-to-parallel converter. Special printer drivers are required on the disk containing any Macintosh software that will use this printer.

QUALITY AND PERFORMANCE

For the price, this is a very sturdy printer. It uses standard industry ribbon cartridges.

A cps of 55 is pretty quick for a daisy-wheel printer. If you need speed and want quality, you should look into this printer.

VENDOR SUPPORT

This printer has a 1-year warranty and a national service network. C. Itoh

printers are distributed by Leading Edge Products, Inc. and are supported by their authorized service centers.

LaserWriter

$6995.00

Apple Computer, Inc.

RATINGS		FEATURES	
A	Overall rating	Type:	Laser
B	Price/performance	Speed:	8 pages/min. maximum
B	Software compatibility	Bidirectional:	+
A	Ease of installation	Logic-seeking:	+
A	Documentation	Centronics parallel:	–
A	Vendor support	Serial:	+
		Friction feed:	–
		Pin feed:	–
		Characters per line:	depends on font size
		Paper size:	to 8.5″ wide

PRODUCT SUMMARY

The LaserWriter represents the state of the art in printer technology (Fig. 6-1).

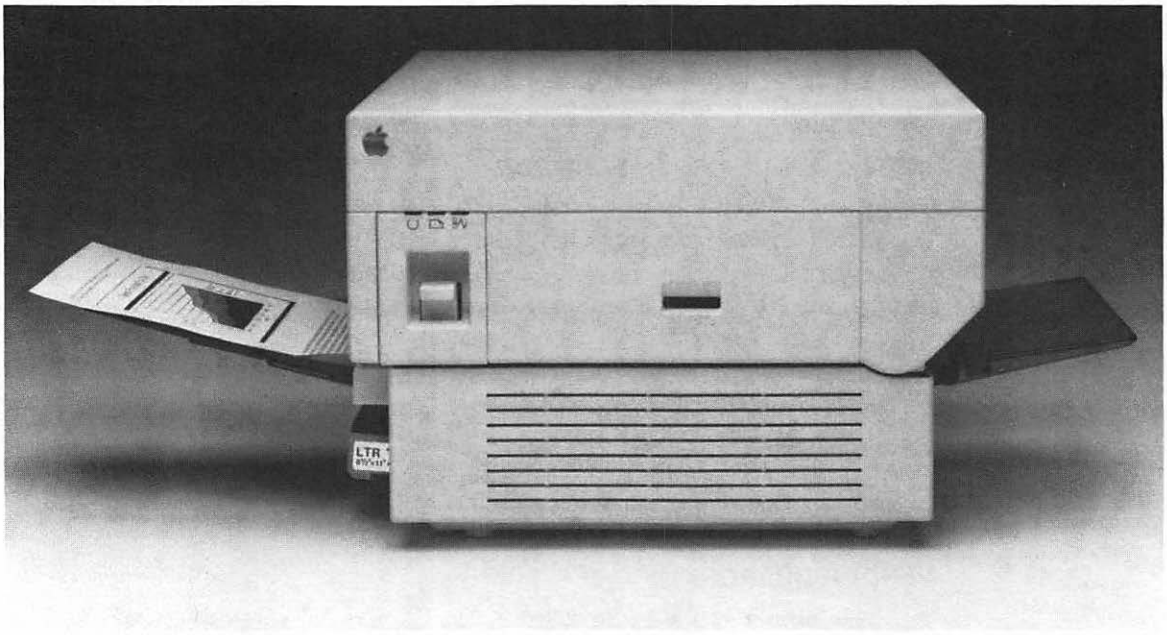

Fig. 6-1. The Apple LaserWriter Printer (courtesy Apple Computer, Inc.).

Its price puts it out of the reach of most home computer users; however, it is a viable alternative for most businesses. This printer can provide the small business and large company with a superb printing tool that is capable of producing near typeset quality for both text and graphics. The LaserWriter can be used to produce newsletters, reports, business forms, transparencies, and any material of presentation quality.

The LaserWriter has been licensed to use the original Times and Helvetica typefaces. The Times typeface is the typeface used most commonly in newspapers. Helvetica is a common typeface for business forms.

The LaserWriter includes a 2-megabyte computer. About 500K is used for read-only memory and about 1500K for random access memory. This memory is required to allow the printer to compose each page to be printed and to print each page composed.

It uses an interpretive programming language called PostScript developed by Adobe Systems Incorporated to generate text characters and graphics. All text and graphics produced by the LaserWriter are printed at 300 dots per inch. The LaserWriter supports letter size, legal size, and A4 and B5 paper sizes. It can also handle transparencies, labels, and envelopes.

It is supported by the AppleTalk Personal Network which allows up to 32 devices to be linked together. These devices can include Macintosh computers, hard disks, file servers, and a LaserWriter. Standard RS-232C devices can also be connected to the LaserWriter via an RS-232C port on the printer.

FEATURES FOR WORD PROCESSING

The LaserWriter supports all important word processing features such as boldfacing, underlining, subscripting, superscripting, and proportional spacing. It is capable of supporting all of the fonts presented on the Macintosh. It can successfully combine both text and graphics as used by Macintosh word processors.

FEATURES FOR GRAPHICS

The LaserWriter produces graphics of near-professional quality. These graphics are superb.

INSTALLATION AND INTERFACING

The LaserWriter uses both the AppleTalk and RS-232C interface conventions. It must be connected to the Macintosh via the AppleTalk network and requires the installation of the LaserWriter drivers and fonts on the disks of those applications that will be using the printer.

QUALITY AND PERFORMANCE

The quality of output of the LaserWriter is superb. Its performance is excellent. A few earlier releases of such software as Microsoft Word are not fully supported by the LaserWriter due to software problems. Such programs are being released in versions that are fully supported by the printer. As a matter of caution, you should recognize that the LaserWriter produces its first copy of a printed page quickly when

the Times or Helvetica fonts are being used. If other Macintosh fonts are used, the first page may take several minutes since the page is being generated as a graphic. This takes much longer than it takes to make use of the fonts that are already installed in the memory of the LaserWriter itself. Once the first copy of such a page has been printed, additional copies take the same amount of time as additional pages generated with the LaserWriter's internal fonts.

VENDOR SUPPORT

The LaserWriter has the standard Apple 90-day warranty. It has been designed to be repaired easily with its mechanical parts contained in its Canon LBP-CX laser-xerographic print engine. A disposable cartridge holds toner and those parts that are most likely to wear. This cartridge costs about $100. Each cartridge can produce between 2000 and 3000 copies before it must be replaced. Service is available throughout the world from Apple Computer's large network of authorized dealers and repair facilities.

WORKSHEET FOR FULLY-FORMED-CHARACTER PRINTERS

Product $

Manufacturer

RATINGS	FEATURES
Overall rating	Type:
Price/performance	Speed:
Software compatibility	Bidirectional:
Ease of installation	Logic-seeking:
Documentation	Centronics parallel:
Vendor support	Serial:
	Friction feed:
	Pin feed:
	Characters per line:
	Paper size:

PRODUCT SUMMARY

FEATURES FOR WORD PROCESSING

FEATURES FOR GRAPHICS

INSTALLATION AND INTERFACING

QUALITY AND PERFORMANCE

VENDOR SUPPORT

Table 6-1. Comparative Ratings for Fully-Formed-Character Printers.

Printer	Price	Ratings					
		1	2	3	4	5	6
Apple Daisy Wheel	$2195.00	A	C	B	A	A	B
CR-II (parallel)	599.00	A	A	B	A	B	B
CR-II (serial)	649.00	A	A	B	A	B	B
CR-III (parallel)	995.00	A	A	B	B	B	B
CR-III (serial)	1045.00	A	A	B	B	B	B
Diablo 630 ECS	2529.00	A	A	A	B	A	B
DX-15	499.00	A	A	B	A	B	B
EXP-500	549.00	B	B	B	A	B	B
F10 Printmaster	1995.00	B	A	B	B	B	A
F10 Starwriter	1795.00	B	A	B	B	B	A
LaserWriter	6995.00	A	B	B	A	A	A

Key to Ratings

1—Overall rating
2—Price/performance
3—Software compatibility
4—Ease of installation
5—Documentation
6—Vendor support

Table 6-2. Comparative Features for Fully-Formed-Character Printers.

Printer	Features									
	1	2	3	4	5	6	7	8	9	10
Apple Daisy Wheel	D	40	+	+	–	+	+	+	198	15
CR-II	D	12	+	+	+	+	+	–	110	13.5
CR-III	D	23	+	+	+	+	+	–	132	14-7/8
Diablo 630 ECS	D	40	+	+	+	–	+	–	132	13.2
DX-15	D	13	+	+	+	+	+	–	110	13.5
EXP-500	D	16	+	+	+	+	+	–	132	13.2
F-10 Printmaster	D	55	+	+	+	+	+	–	136	15
F-10 Starwriter	D	40	+	+	+	+	+	–	136	15
LaserWriter	L	8P/M	+	+	–	+	–	–	N/A	8.5

Key to Features

1—Type (D = Daisy-wheel, L = Laser)
2—Speed (characters per second)
3—Bidirectional
4—Logic seeking
5—Centronics parallel
6—Serial
7—Friction feed
8—Pin feed
9—Characters per line
10—Paper size (inches)

Chapter 7

Interface Devices

In order to connect your Macintosh to more than one printer, to a parallel printer, or to serial devices in numbers that exceed the serial ports on the back panel of the Macintosh, you might wish to try a serial-to-parallel converter, a serial expansion device, or a serial/parallel expansion device. Epson printers may be adapted for use with the Macintosh by installing an interface board in the printer to make the printer respond to instructions from the Macintosh, accept data from the Macintosh, and even act like it is an ImageWriter.

These items are all interface devices that allow the Macintosh to use a particular interface standard with external devices. The standards used in the Macintosh's internal circuitry and the standards used by interface devices will allow you to connect the Macintosh to any printer, plotter, or other device and specify how to transfer information.

The most common data format used in the industry for character and command representation is ASCII. The three hardware standards are the RS-232C, the Centronics, and IEEE-488.

Standards are used for the handshaking signals and for the protocol, which is used to format the transmitted data. In order for two machines made by different manufacturers to work together, they must have the same protocol.

The *RS-232C* is a serial interface for transmission. It designates the specific voltage levels, the required driver, and the receiver characteristics for 21 circuits. Information moves sequentially between the computer and the printer. Serial transmission can be somewhat slow because of the need to split each byte into its 7 or 8 bits and then recombine it after it has been received. Even at a relatively

slow transmission rate of 240 characters per second, however, most printers cannot keep up. Thus, it is usually printer speed, rather than interface transmission speed, that limits how fast printing is accomplished.

The serial connection, as defined by the connector and cables used, involves either 5, 9, or 25 different wires, each having a defined use. In most uses for printer and modems, however, not all of the 5, 9, or 25 wires are needed to make the proper connection to a serial device. Usually only data set ready and data ready handshaking lines, signal ground, and send data are needed. The manual that accompanies the device should be consulted to obtain the information regarding which wires should be used to make the connection.

The parallel *Centronics-type interface* uses 36 different wires which send 7- or 8-bit bytes of information simultaneously. This is much quicker than the serial interface. The other wires are used for the handshaking signals. The only way that a Macintosh can use a parallel printer is for the serial signal generated by the Macintosh to be converted into a parallel signal. This task is accomplished by a serial-to-parallel converter. These devices must be connected to the Macintosh with a plug that is compatible with the Macintosh's printer port or modem port. The other end of the device must have a plug that is compatible with the printer being used. Plugs and cables are available from most electronics parts stores. The Macintosh uses a DB-9 connector. The printer may use a Centronics connector or a similar connecting plug. Authorized repair centers have diagrams of the pins used by the Macintosh to transmit and receive data. Printer manuals have the same information regarding the plug requirements for a printer.

Some printers come with only one type of interface, either parallel or serial. For example, the Apple ImageWriter printer comes only with a serial interface. Others come in either a serial or a parallel version; you select which form when you buy the printer. In some cases, the serial interface version costs a bit more than the parallel version. Finally some printers come with both a serial and a parallel interface built in. You can connect to either type of interface card and merely need to set a DIP switch to let the printer know which interface connection to use.

By contrast, almost all external modems require not only a serial interface, but a specific type of serial interface, namely the EIA RS-232C serial interface.

Another consideration in the use of the interface is the cable connection between the Macintosh's serial circuits and the printer or modem. Obviously you need to be certain that the cable is long enough to reach from your computer to the peripheral device. In the case of a printer you may well want the printer to be some distance from the computer so that its noise will not be too oppressive. You should be aware, however, that long cables are quite expensive, and some of the electrical signals can be lost over a very long cable. Unshielded cables can also emit radio frequency interference (RFI), messing up any television reception in the nearby area.

Centronics printer cables consist of 36 wires, each of which carries an important signal. On the Macintosh's serial ports there are only five output/input lines; the additional line is receive data which is used in modem connections. The 25-pin connector used to connect the serial cable to the serial printer or modem is known as a DB-25 connector.

The Macintosh does not require interface cards for a printer or a modem; in-

deed there is no place to put a card. Instead, it has two ports on the rear of its case. One port, with a printer icon above it, is meant for connection to a serial printer. The other port, with a telephone icon, is designed for connection to a modem. The ports require a special cable with a DB-9 connector on one end for connecting to the Macintosh and whatever connector is required on the other end for connecting to the printer or modem.

Users of the Macintosh are not required to use a serial printer. Several companies manufacture serial-to-parallel adapters that convert the serial output of the Macintosh's ports to a parallel signal which can be used by a Centronics-compatible printer. These adapters are reviewed in this chapter.

Many printers have graphics capabilities; that is, they can print a replica of the Macintosh graphics screen or otherwise print pictures using a series of dots. These printers, however, generally need software commands to tell them to print the picture, and they usually require special programming to convert the representation of the Macintosh graphics screen to a printed picture. While this can be a complicated process, several software packages, such as Pro Print, the Mac Epson Connection, and the Mac Daisy-Wheel Connection, supply the commands to applications to use such printers. This ability is referred to as graphics dump capability.

AYN Interface

$99.95

Dresselhaus Computer Products

RATINGS		FEATURES	
B	Overall Rating	Type:	Epson Serial interface
B	Price/performance	Serial/Parallel:	S
B	Software compatibility	Graphics dump:	N/A
B	Ease of installation	Text dump:	N/A
B	Documentation	Printer specific:	Epson
B	Vendor support	Buffer size:	N/A

PRODUCT SUMMARY

The AYN printer interface provides the Macintosh user with a serial interface card which must be installed in the Epson FX-80 printer, a connector cable, printer firmware, and Finger Print software. AYN is an acronym for *All You Need.* In truth, it is all you need for the Epson FX-80 printer, only. This interface card is easy to install. It is supplied with adequate documentation for installation and use.

HanZon Universal Serial Interface Card

$129.00

HanZon Data Inc.

RATINGS		FEATURES	
B	Overall rating	Type:	Serial interface adapter
B	Price/performance	Serial/Parallel:	Serial to Parallel
B	Software compatibility	Graphics dump:	+
B	Ease of installation	Text dump:	+
B	Documentation	Printer specific:	Epson
B	Vendor support	Buffer size:	2K

PRODUCT SUMMARY

This interface card makes an Epson printer react to data and commands sent from the Macintosh as though the printer was an ImageWriter. Instructions for installation are provided by the manufacturer, and are easy to follow. Installation is not difficult. The only tool that is required to accomplish installation is a Phillips screwdriver. Once the interface board has been installed, the DIP switches that control the various printer settings must be reset in the manner described in the installation instructions to ensure that the Epson printer emulates an ImageWriter. This device may be installed in Epson MX, FX, and RX models.

The Universal Serial Interface Card works in the Epson mode, which is compatible with software that includes printer drivers specific to Epson printers. It also works in the Apple Mode, causing the Epson printer to emulate the Apple ImageWriter printer. When this interface card has been installed in an Epson printer, the printer can function as both a serial and a parallel printer, depending upon the cable used to connect the computer to the printer.

A nonstandard cable is provided by the manufacturer to connect the Macintosh to the Epson printer via a connector that is built into the interface card. If this connector cable is not supplied with the interface card, it may be ordered directly from the manufacturer. It is identified as Part No. 12356.

The Universal Interface card uses the RS-232C serial interface standard. Baud rates of 300, 600, 1200, 2400, 4800, 9600, and 19200 may be used. It contains a 2K buffer. The interface card is supplied with a complete, yet concise, manual, which contains installation instructions. HanZon Data provides technical support and a 1-year warranty for parts and labor.

MacEnhancer

$249.00

Microsoft Corporation

RATINGS		FEATURES	
A	Overall rating	Type:	Serial/parallel expansion device
A	Price/performance	Serial/Parallel:	S/P

B	Software compatibility	Graphics dump:	N/A
A	Ease of installation	Text dump:	N/A
A	Documentation	Printer specific:	N
A	Vendor support	Buffer size:	N/A

PRODUCT SUMMARY

The MacEnhancer is an expansion system for the Macintosh that provides the user with one parallel and two serial ports connected to one of the Macintosh's serial ports. Printer driver software is provided for a variety of printers. Terminal emulation software is also provided. This compact device provides the user with one IBM-compatible parallel port and two IBM-compatible serial ports. The MacEnhancer installation software makes the MacEnhancer a Macintosh desk accessory. This type of installation makes it possible to use this device from within Macintosh applications.

Printer drivers are provided for the Epson FX, MX, and LQ series of printers. They are also provided for the Toshiba P1351, Toshiba P1340, C. Itoh Prowriter, H-P ThinkJet, IBM Graphics, Okidata Microline 92, and Okidata Microline 93 printers. Terminal emulation software supplied by the manufacturer allows the Macintosh to communicate with mainframes and with a variety of personal computers.

Connection is extremely easy. Only the cord for connection to the Macintosh is provided.

MBIS Microbuffer

32K—$299.00
64K—$349.00

Practical Peripherals

Additional 64K Modules—$179.00

RATINGS		FEATURES	
B	Overall rating	Type:	Serial interface buffer
B	Price/performance	Serial/Parallel:	S
B	Software compatibility	Graphics dump:	N/A
B	Ease of installation	Text dump:	N/A
B	Documentation	Printer specific:	N
B	Vendor support	Buffer size:	32K-256K

PRODUCT SUMMARY

The MBIS Microbuffer is a serial interface buffer that may be connected between the Macintosh and any other serial device. It would be used most frequently between the Macintosh and a printer to provide the user with temporary external memory capacity. This external memory allows data to be transferred from the computer at a much higher rate than occurs when the computer is connected directly to the printer. This buffer uses the RS-232C interface standard. Its baud rate ranges between 75 and 9600. The buffer is supplied with 32K or 64K of volatile memory. It can be expanded to 256K in 64K increments. It has a Copy feature that allows up to 255 copies of any file to be made by the user. The buffer contains circuitry

for unbuffered reverse communications with the computer. Proper interface cards must be obtained to ensure that this buffer may be connected properly to the Macintosh and to the serial device that is connected to the buffer.

Printer Optimizer

Applied Creative Technology, Inc.

1 serial/1 parallel—$598.00
2 serial/1 parallel—$647.00

RATINGS		FEATURES	
B	Overall rating	Type:	Printer controller/buffer
B	Price/performance	Serial/Parallel:	S/P
B	Software compatibility	Graphics dump:	N/A
A	Ease of installation	Text dump:	N/A
B	Documentation	Printer specific:	N
B	Vendor support	Buffer size:	Up to 256K

PRODUCT SUMMARY

The Printer Optimizer is a combination printer buffer, spooler, multiple printer controller, serial-to-parallel adapter, printer emulator, electronic mailbox, and protocol converter. This particular device is quite flexible and quite useful. Its large memory can assist anyone who has large documents to print. Due to some incompatibility with the Macintosh printer drivers, you should avoid the highest-quality print setting available from Macintosh applications. If the standard printer setting is used, most documents will be printed in a format equal to the high-quality setting for the ImageWriter. Cables allowing the Macintosh to be connected to this device are available directly from the manufacturer in a variety of sizes.

Universal Data Buffer

HanZon Data, Inc.

64K—$385.00
128K—$478.00
192K—$566.00
256K—$654.00

RATINGS		FEATURES	
B	Overall rating	Type:	Data/printer buffer
A	Price/performance	Serial/Parallel:	S/P
A	Software compatibility	Graphics dump:	N/A
A	Ease of installation	Text dump:	N/A

RATINGS	FEATURES	
B Documentation	Printer specific:	N
B Vendor support	Buffer size:	64K-256K

PRODUCT SUMMARY

The Universal Data Buffer may be used to transfer data between computers, from a computer to a printer, from a computer to a modem, and from a computer to either parallel or serial devices. This buffer may be installed in a Macintosh system by utilizing a nonstandard connecting cable supplied by HanZon Data, Inc. This cable must be ordered separately if the buffer is purchased from most retail outlets. If you order the buffer directly from the manufacturer, you should request the Macintosh connector cable (Part No. 12356). Two of these cables must be ordered if the ImageWriter printer is connected to the buffer. One of these cables would be used to connect the Macintosh to the buffer; the other would be used to connect the buffer to the ImageWriter.

The Universal Data Buffer is supplied with 64K of volatile memory. It may be expanded in 64K increments up to 256K. It can accept data from its source in either serial or parallel format and can send the same data to its destination in either serial or parallel format.

The buffer's serial ports use the RS-232C interface standard. Baud rates from 300 to 19200 may be employed with this device. Parity may be odd, even, or none. Serial ports are configured automatically by the buffer. The parallel ports on this buffer use the Centronics interface standard. A 36-pin Centronics connector is used for parallel input and output connections.

Information flow between the buffer and the device to which it is connected may be suspended by using the buffer's pause feature. Multiple copies of files may be printed by setting the buffer's copy control up to 255 duplicate copies. Data can be sent to a parallel device and a serial device simultaneously. Baud rates may be set by using DIP switches.

The manufacturer provides technical assistance to users. The buffer is warranted for parts and labor for 1 year.

WORKSHEET FOR INTERFACE DEVICES

Product

$.

Manufacturer

RATINGS	FEATURES
Overall rating	Type:
Price/performance	Serial/Parallel:
Software compatibility	Graphics dump:
Ease of installation	Text dump:
Documentation	Printer specific:
Vendor support	Buffer size:

PRODUCT SUMMARY

Table 7-1. Comparative Ratings for Interface Devices.

Device	Price	Ratings					
		1	2	3	4	5	6
AYN Interface	$ 99.95	B	B	B	B	B	B
HanZon Serial Interface Card	129.00	B	B	B	B	B	B
MacEnhancer	249.00	A	A	B	A	A	A
MBIS Microbuffer 32K	299.00	B	B	B	B	B	B
MBIS Microbuffer 64K	349.00	B	B	B	B	B	B
Printer Optimizer 1S/1P	598.00	B	B	B	A	B	B
Printer Optimizer 2S/1P	647.00	B	B	B	A	B	B
Universal Data Buffer 64K	385.00	B	B	B	A	B	B
Universal Data Buffer 128K	478.00	B	B	B	A	B	B
Universal Data Buffer 192K	566.00	B	B	B	A	B	B
Universal Data Buffer 256K	654.00	B	B	B	A	B	B

Key to Ratings

1—Overall rating
2—Price/performance
3—Software compatibility
4—Ease of installation
5—Documentation
6—Vendor support

Table 7-2. Comparative Features for Interface Devices.

Device	Features				
	1	2	3	4	5
AYN Interface	S	N/A	N/A	Yes	N/A
HanZon Serial Interface	S/P	N/A	N/A	Yes	2K
MacEnhancer	S/P	N/A	N/A	No	N/A
MBIS Microbuffer	S	N/A	N/A	No	32k-256K
Printer Optimizer 1S/1P	S/P	N/A	N/A	No	64k-256K
Printer Optimizer 2S/1P	S/P	N/A	N/A	No	64k-256K
Universal Data Buffer	S/P	N/A	N/A	No	64k-256K

Key to Features

1—Serial/parallel
2—Graphics dump
3—Text dump
4—Printer specific
5—Buffer size

Chapter 8

Modems

A *modem* is a device that enables your computer to communicate with another computer many miles away using the public telephone lines. Modem is an acronym for *MOdulator-DEModulator*, which also explains what it does. Since computers talk in digital codes, and telephone lines listen in analog codes, the data from the computer must first be translated before it goes over the telephone lines. When the computer is sending data, the modem modulates the digital signal into the analog signal. When the computer is receiving data, the modem demodulates the analog signal into the digital signal.

A modem requires communications software so you can send data from the keyboard and display incoming data on the screen. Sometimes this software is provided with the modem, and includes commands for setting protocols not included in the RS-232C standard. Both the sending and the receiving computer must agree on a number of items (speed of transmission, parity, duplex, Bell prototype, etc.) before they can exchange data. This agreement is accomplished with software. Under some circumstances, the software that is provided with the modem may not meet your needs. You can purchase other software to provide you with convenient features for the modem, depending on your individual needs. When you purchase such software, make sure it is compatible with your particular modem.

The main questions for a modem buyer are:

- ☐ How fast can it transmit data?
- ☐ How does the modem connect to the computer?
- ☐ Can the data be transmitted one way or two ways?

TRANSMISSION SPEED

The two most popular speeds for home computer users are 300 bits per second (or baud) and 1200 bits per second. Speed is important for two reasons. First, the companies with which you communicate charge by the hour and by the baud. For example, CompuServe charges $5 per hour for 300 baud, or $17.50 per hour for 1200 baud in off hours. It takes about 1 minute to transfer 2000 bytes of text at 300 baud.

If you plan to use your Macintosh primarily to transmit and receive data, applications, etc., a 1200-baud modem is the slowest modem you should consider. All such modems cost more, but the speed is necessary for the serious user.

Speed is also important when large amounts of information are to be transferred. Since you are using phone lines, there is the telephone bill to consider. We recommend a modem with 1200 baud for any but the most casual user, since most users find themselves in the position of wishing their modem was that fast shortly after purchasing a slower modem.

CONNECTING THE MODEM

There are two ways to connect the modem. Either the telephone receiver is placed in a cradling device, called an *acoustic coupler*, or a jack is plugged into the modem and the phone. The second way is called a *direct connection*. The direct connection offers the best transmission, is less expensive, and more than meets the needs of the Macintosh user. The telephone company will check to see that it meets with regulations.

ONE-WAY OR TWO-WAY TRANSMISSION

One-way or two-way transmission indicates whether data can be transmitted and received at the same time and in both directions. One-way is referred to as *half-duplex* and works like a CB radio transmission: only one person can talk at a time. Two-way, or *full-duplex*, works like a telephone where two people can talk simultaneously.

Modems are either compatible with the Bell 103/113, the Bell 202, or the Bell 212A, and in some cases with two of these. There are one or two others; however, the Macintosh user will be interested in the ones we have mentioned. Some information utilities with which you want to receive information will only use one of these. The Bell 212A is the fastest and most expensive of the three.

FEATURES

A manufacturer might indicate that its modem is full-featured, even though it does not contain all the possible modem features. Here is a list and brief description of the modem features:

Auto answer indicates the modem will answer its own calls automatically. You do not have to be there.

Built-in self test is circuitry that checks for errors and the modem's capability

to send and receive data. The test modes include analog loop-back, digital loop-back and remote digital loop.

A built-in speaker allows the user to monitor all activity before the computers are connected. The speaker enables the user to hear a busy signal or a voice response.

Busy mode is for those times when you want to use your system for something else and not receive calls. It is like taking the phone off the hook.

Command abort is a signal that interrupts the transmission before the call is completed. Some modems will use one or two carriage returns for this purpose.

Command mode allows you to use software to direct the modem's operation.

Command recognition is the ability of the modem to accept commands at different speeds or parity. Some modems require specific speeds for commands, while others do not.

Dialing directory lets you store frequently used telephone numbers and 20 to 60 explanation characters.

Dial tones, pulse or touch tones, are what the telephone company responds to and may also include a second tone for additional numbers. The tone put out by the modem must correspond to the tone used by your telephone.

Directory modification is the ability to change the phone numbers listed in the directory.

Help command gives you access to the help files by typing either an **H** or **HELP**.

Last number redial automatically redials the last number dialed.

Manual dial permits you to dial a number by typing it in from the keyboard.

Modem register contents are used to check or modify the contents of the modem's internal memory register.

Modem switches are required by some software for the program to function properly. They are set either through software or manual switch control.

Name selection dialing is used to type in a name on the keyboard which corresponds to a directory number to be dialed.

Number linking indicates a second number to be dialed if the first number dialed is busy.

Originate/Answer allows you to send and receive data.

Originate Only only permits data to be sent and not received.

Protocol detect and switch determines the protocol of the incoming call and switches its protocol to match it.

Quit command allows the user to turn off the internal monitor programs.

Repeat dialing allows for repeated dialing of a phone number a specific number of times.

Set answerback string is used to eliminate typing in the responding code words (answerback string) each time.

Set attention character allows you to get the modem's attention to give it further commands while it is transmitting or receiving data.

Set backspace character allows you to select any character and designate it as a backspace key.

Set disconnect character enables you to designate one to two characters that will cause the modem to break the connection.

INFORMATION SERVICES

There are a number of services available to the Macintosh user. They include, among others, stock market prices, encyclopedia references, current news and weather, and movie and book reviews. There is a charge for these services, as well as a registration fee which varies. The most popular information services follow.

The Source, 1616 Anderson Rd., McLean, VA 22102 provides daily news, excerpts from financial publications, financial reports on over 3000 companies, bond and commodity prices and movie and restaurant reviews. It also provides an electronic catalog for purchase of items, electronic mail, and games. The registration fee is $100 and connection costs run from $7.75 to $20.75 per hour. Sometimes reduced registration fees are offered to purchasers of particular modems. Check for such special offers when you purchase a modem. These offers are generally advertised on the modem package.

The Dow Jones News/Retrieval, Box 300, Princeton, NJ 08540 provides current or prior stock prices for all companies on the major exchanges. It also provides financial disclosures and news affecting particular companies. You have access to articles from the *Wall Street Journal* and *Barrons*, as well as a 20-volume encyclopedia. Some modems provide a free subscription to this service and the connection costs ranges from $.15 to $1.20 per minute.

Dialog's Knowledge Index, 3460 Hillview Avenue, Palo Alto, CA 94304 provides technical information and includes summaries and complete copies of over 7 million articles, reports, and books. Over 25,000 publications by the United States Government Printing Office are available. The registration fee is $35.00 and the connection cost is $24 per hour. Dialog has been selected by Apple Computer, Inc. as the information service that will provide Macintosh developers with the latest updates to developer software and with updates to the technical reference work for developers. This reference work is called *Inside Macintosh*.

CompuServe Information Service, 5000 Arlington Center Blvd., Columbus, OH 43320 provides investor-oriented information, including stock quotes and historical data for over 40,000 companies, as well as data from Standard & Poors and Value Line. There is also a service which provides you with technical assistance for operating your computer. Registration is $40.00 and may be free with some modems. CompuServe is the home of one of the largest and most popular bulletin board services for Macintosh users. This bulletin board is called the Micronet Apple User Group (M.A.U.G.). This bulletin board may be reached by using the **GO PCS 51** command from CompuServe's Consumer Information Service. This bulletin board provides the Macintosh user with a chance to communicate with other users via electronic mail, to read the latest gossip about the Macintosh and Macintosh products, and to download a variety of Macintosh applications and files.

Other information is available locally through bulletin boards, including consumer products, local meetings, dating services, and ride sharing. Another source is electronic mail, which permits you to send a message that is then held for someone away from their office or home. There is a postal service where you type in a letter and send it, and it is printed and delivered on the receiving end. In some cases the service guarantees 4-hour delivery.

You may use your modem for your banking and bill-paying needs. Funds can be transferred between accounts; bills can be paid, and you can receive current statements. School work can be sent and received with a modem, or you can carry on a remote chess game and never leave your home.

Apple Modem

300 baud—$225.00
1200 baud—$495.00

Apple Computer, Inc.

RATINGS		FEATURES	
A	Overall rating	Connection:	Direct
B	Price/performance	Bell prototype:	103/212A
A	Ease of installation	Operations:	Auto dial/answer
A	Documentation	Voice:	+
B	Vendor support	Baud rate:	300/1200
		Duplex:	Full/half
		Dialing:	Tone/pulse

PRODUCT SUMMARY

The Apple Modem comes in two forms, as a 300-baud, Bell 103 modem and as a 1200-baud, Bell 212A modem. The 1200-baud modem also functions in the 300-baud form.

The modem is relatively small and quite thin. It will fit comfortably under a standard desktop telephone. The modem has a built-in speaker with an adjustable volume control so you can listen to the dialing and connection and determine if the reason for no carrier is a busy signal, dead line, or no answer. The speaker also lets you hear messages about new numbers if the number has changed. Once the carrier has been detected, the speaker shuts off so you do not have to listen to the high-pitched modem tones. The volume control on the modem can be adjusted with an Allen wrench.

The cable connector on the back of the modem is not a standard DB-25 connector that you expect with an RC-232C interface. Instead it is a DB-9. All the necessary wires are present but you do need a special cable, which Apple provides as part of the accessory kit for the Macintosh. Each modem is provided with a manual that describes the easy hookup procedure for the Macintosh and describes the operation of the modem. No terminal software is provided with these modems. You must purchase a commercial communications software program such as MacTerminal, InTouch, Versaterm, or Mite.

The Apple Modem is similar to the Password Modem. Indeed, both modems are built by U.S. Robotics. The main difference between the two is in the form of the connector on the back of the modem.

Hayes Smartmodem 300

$199.00

Hayes Microcomputer Products, Inc.

RATINGS		FEATURES	
A	Overall rating	Connection:	Direct
A	Price/performance	Bell prototype:	103
A	Ease of installation	Operations:	Auto dial/answer
A	Documentation	Voice:	-
B	Support	Baud rate:	300
		Duplex:	Full/half
		Dialing:	Tone/pulse

PRODUCT SUMMARY

The Hayes Smartmodem 300 is one of the most popular modems available for personal computers. It has become a standard against which other modems are compared. Most decent terminal programs support the Hayes or are designed for it.

The Hayes is "smart" because it has some software built into it. You can send commands to it directly through the keyboard or from a software program.

The Hayes Smartmodem 300 is an external modem that works with any RS-232C port. It can be connected to the Macintosh by using a 9-pin connector on the Macintosh end of the cable. This connector must be plugged into the modem port on the back panel of the computer, unless the communications software you are using allows you to switch ports.

The only drawback with the Smartmodem is the price for a 300-baud modem. If you want a low-cost telecommunications system, you may not want to pay for the extra price. If however, you want a rugged modem that will be compatible with most software, then this is the modem to get.

There is a 1 year warranty with the Hayes Smartmodem 300.

Hayes Smartmodem 1200 $599.00

Hayes Microcomputer Products, Inc.

RATINGS		FEATURES	
A	Overall rating	Connection:	Direct
A	Price/performance	Bell prototype:	212A
A	Ease of installation	Operations:	Auto/manual dial
B	Documentation		Auto/manual answer
B	Support	Voice:	-
		Baud rate:	1200
		Duplex:	Full/half
		Dialing:	Tone/pulse

PRODUCT SUMMARY

The Hayes Smartmodem 1200 is the most popular modem around. The 1200 contains some of the communications software inside itself; so you can send commands to the modem directly from the keyboard—a real timesaver. Because of the Hayes protocol has become a standard, most terminal and communications programs support and are designed to run on the Smartmodem.

The Hayes Smartmodem 1200 is an external modem and will hook up to the RS-232C/RS-422 modem port. You must supply your own cable.

The Smartmodem is not the cheapest modem on the market, but is certainly one of the best. If you have a lot of data to transfer over long distances, or if you just spend a lot of time on a modem, then this would be a smart purchase.

As far as the actual function of the modem, Hayes has a good reputation. Its products rarely fail, which is very important when the data you are transmitting is critical. If it is text, then a small error here or there can easily be fixed. If, however, you are transmitting binary files, one missed or skewed bit could render the whole transmission useless. A high-integrity modem can be very important.

The Hayes Smartmodem 1200 come with a 1-year warranty.

Hayes Smartmodem 2400 $899.00

Hayes Microcomputer Products, Inc.

RATINGS		FEATURES	
B	Overall rating	Connection:	Direct
B	Price/performance	Bell prototype:	103/212A
B	Ease of installation	Operations:	Auto dial/answer
B	Documentation	Voice:	+
A	Vendor support	Baud rate:	300/600/1200 /2400
		Duplex:	Full/half
		Dialing:	Tone/pulse

PRODUCT SUMMARY

The Smartmodem 2400 (Fig. 8-1) is a state-of-the-art device that provides the Macintosh user with extremely powerful communications capabilities. It offers both full- and half-duplex communications at all of its transfer speeds. It can communicate synchronously and asynchronously. It contains chips and circuits that allow high-speed data transfer to be carried out with the fewest possible errors. It provides the user with voice/data switching, which allows calls to be monitored as they are made in the voice mode and then allows communications after connection to be carried out in the data mode. The modem can monitor the progress of a call and can identify busy signals, dead lines, and the lack of a dial tone. Voice and data modes can be used easily during data-transfer activities. You can switch back and forth

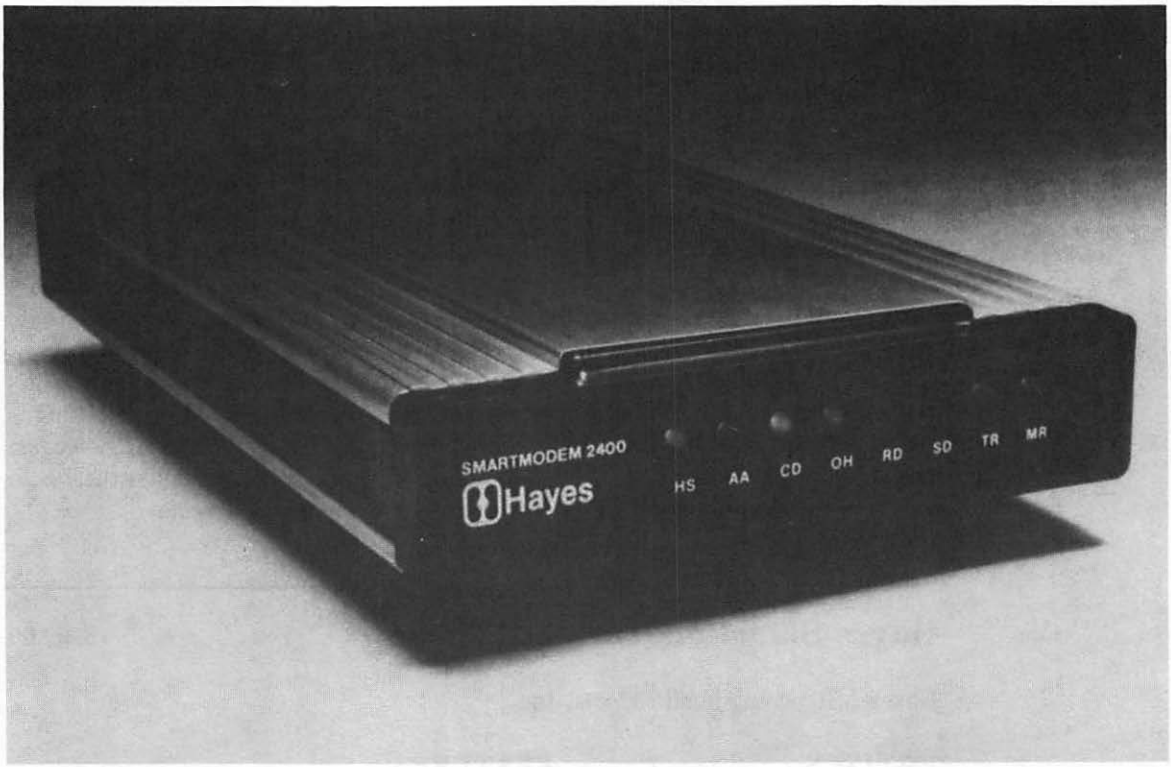

Fig. 8-1. The Hayes Smartmodem 2400 (courtesy Hayes Microcomputer Products, Inc.).

as needed The modem contains a number of built-in diagnostic routines to detect modem and phone-line problems. The modem is supplied with a transformer, a modular phone cable, and a clear, complete manual. Installation is made by using a 9-pin connector to attach the modem to the Macintosh. Hayes provides a 2-year limited warranty with an option to extend this warranty to 4 years. The manufacturer also provides a customer service line that operates from 8 A.M til 8 P.M. Eastern Standard Time.

Password

U.S. Robotics, Inc.

300 baud—$199.00

1200 baud—$449.00

RATINGS

A Overall rating
A Price/performance
A Ease of installation
B Documentation
B Vendor support

FEATURES

Connection:	Direct
Bell prototype:	103/212A
Operations:	Auto dial/answer
Voice:	+

FEATURES

Baud rate:	300/1200
Duplex:	Full/half
Dialing:	Tone/pulse

PRODUCT SUMMARY

The Password comes in two forms: the Password 300, which is a 300-baud, Bell 103 modem, and the Password 1200, which is a 1200-baud, Bell 212A modem. The 1200-baud modem also functions as a 300-baud modem.

The modem fits comfortably under a standard desktop telephone. It has a built-in speaker with an adjustable volume control so you can listen to the dialing and connection and determine if the reason for no carrier is a busy signal, dead line, or no answer. The speaker also lets you hear messages about new numbers if the number has changed. Once the carrier has been detected, the speaker shuts off so you do not have to listen to the high-pitched modem tones. The volume control on the modem can be adjusted with an Allen wrench.

To install the modem you merely connect it with a standard RS-232C cable with a DB-25 connector. The Password is similar to the Apple Modem, which is also built by U.S. Robotics. The main difference is that the Password has a standard DB-25 connector on its back.

POPCOM X100

$475.00

Prentice Corporation

RATINGS

B	Overall rating
B	Price/performance
B	Ease of installation
A	Documentation
A	Vendor support

FEATURES

Connection:	Direct
Bell prototype:	103/212A
Operations:	Auto dial/answer
Voice:	+
Baud rate:	300/1200
Duplex:	Full/half
Dialing:	Tone/pulse

PRODUCT SUMMARY

The POPCOM X100 is a very small, external modem. It can transmit data in 300 or 1200 mode. The model is so small that it actually just plugs into the wall and looks like an oversized plug; so it is handy and out of the way at the same time. It also eliminates the need for one more cord at your work station.

All that you need is an RS-232C cable from the computer. The POPCOM accepts Hayes command protocol; so that any program designed to work with the Hayes Smartmodem 1200 or 300 will work with this modem. It also has its own set of commands, which are available to the user in much the same manner as the Hayes com-

mands and can be sent via command strings.

The POPCOM comes with a 2-year warranty from the manufacturer.

ProModem 1200

$495.00

Prometheus Products, Inc.

RATINGS	FEATURES	
B Overall rating	Connection:	Direct
B Price/performance	Bell prototype:	Bell 103/212A
B Ease of installation	Operations:	Auto dial/answer
B Documentation	Voice:	+
A Vendor support	Baud rate:	300/1200
	Duplex:	Full/half
	Dialing:	Tone/pulse

PRODUCT SUMMARY

The ProModem 1200 is a popular 1200-baud modem. It can easily be connected to the Macintosh by using the plug provided by the manufacturer. It is a full-feature modem.

There is a firmware program in ROM that provides terminal functions for the modem. The modem features auto answer, auto dial, and auto redial if a busy signal is received. There is a built-in speaker with volume control to permit you to monitor the status of the phone line. There is also a jack available for a phone handset.

The command set for the modem is compatible with those used for the Hayes Micromodem. The modem also comes with built-in diagnostics.

Smart-Cat Plus

$495.00

Novation, Inc.

RATINGS	FEATURES	
B Overall rating	Connection:	Direct
B Price/performance	Bell prototype:	Bell 103
B Ease of installation	Operations:	Auto dial/answer
B Documentation	Voice:	+
B Vendor support	Baud rate:	300/1200
	Duplex:	Half/Full
	Dialing:	Tone/pulse

PRODUCT SUMMARY

The Novation Smart-Cat Plus is a very versatile modem with a myriad of extra features. It communicates using the Bell 103 protocol at a variety of baud rates, including the standard 110, 300, and 1200, as well as 45.5, 50, 75, and 150. It can communicate in half-duplex or full-duplex mode.

Installation of the Smart-Cat Plus is quite easy. Simply plug the 9-pin connector on the cable supplied with the modem into the modem port on the back panel of the Macintosh. Attach the phone line to the modular jack attached to the modem.

Volksmodem

$79.95

Anchor Automation, Inc.

RATINGS		FEATURES	
B	Overall rating	Connection:	Direct
B	Price/performance	Bell prototype:	Bell 103
B	Ease of installation	Operations:	Auto dial/answer
C	Documentation	Voice:	+
B	Vendor support	Baud rate:	300
		Duplex:	Full/half
		Dialing:	Pulse

PRODUCT SUMMARY

The Volksmodem 300-baud, external modem provides a toggle switch for either phone mode (conversation) or data mode (transmission of data), and a tone sounds if the battery is working. With the switch set to phone mode, there is no drain on the battery and you can use your telephone for normal conversations. There is another switch for either full- or half-duplex. There is a second port for connecting the modem to the base of the telephone. The answer or originate mode is selected automatically.

A cable with a 9-pin connector is required for use with the Macintosh. This cable is connected to the modem port. The Volksmodem also requires a 9-volt battery for the internal power.

The documentation for other than the basics is sketchy, although installation can be done quickly. You will need to purchase communications software to set other parameters.

There is a lifetime warranty on this modem for normal use. Technical support is available from local distributors or the manufacturer.

WORKSHEET FOR MODEMS

Product

$

Manufacturer

RATINGS	FEATURES
Overall rating	Connection:
Price/performance	Bell prototype:
Ease of installation	Operations:
Documentation	Voice:
Vendor support	Baud rate:
	Duplex:
	Dialing:

PRODUCT SUMMARY

Table 8-1. Comparative Ratings for Modems.

Modem			Price	Ratings
Smart cat plus			$495.00	B B B B B
Apple Modem	300 baud	—	225.00	A B A A B
	1200 baud	—	495.00	A B A A B
Hayes Smartmodem 2400			899.00	A A A A B
Hayes Smartmodem 300			199.00	A A A A B
Hayes Smartmodem 1200			599.00	A B A B B
Password	300 baud	—	199.00	A A A B B
	1200 baud	—	449.00	A A A B B
Popcom X100			475.00	B B B A A
Promodem 1200			495.00	B B B B A
Volksmodem			79.95	B B B C B

Key to Ratings

1—Overall rating
2—Price/performance
3—Ease of installation
4—Documentation
5—Vendor support

Table 8-2. Comparative Features for Modems.

Modem	Features						
	1	2	3	4	5	6	7
Smart Cat plus	D	103	Auto D/A	+	300/1200	H	T/P
Apple Modem	D	103/ 212A	Auto D/A	+	300/ 1200	F/H	T/P
Hayes Smartmodem 2400	D	103/ 212A	Auto D/A	+	300/ 1200/2400	F/H	T/P
Hayes Smartmodem 300	D	103	Auto D/A	–	300	F/H	T/P
Hayes Smartmodem 1200	D	212A	Auto D/A Man D/A	–	1200	F/H	T/P
Password	D	103/ 212A	Auto D/A	+	300/ 1200	F/H	T/P
Popcom X100	D	103/ 212A	Auto D/A	+	300/ 1200	F/H	T/P
Promodem 1200A	D	103/ 212A	Auto D/A	+	300/ 1200	F/H	T/P
Volksmodem	D	103	Auto D/A	+	300	F/H	T

Key to Features

1—Connection (D = Direct)
2—Bell prototype
3—Operations (D = Dial, A = Answer)
4—Voice
5—Baud rate
6—Duplex (F = Full, H = Half)
7—Dialing (T = Tone, P = Pulse)

Chapter 9

Monitors

The monitor serves the basic function of displaying information entered from the keyboard and allowing the Macintosh and its software to display messages to the user. The monitor is a computer's viewing screen. It provides a method for the computer to communicate with the user and a method for the computer to verify to the user any input he has made to the computer. It is either built-in (as in the Macintosh) or connected to a composite video adapter board that must be installed inside the Macintosh case between the video connector for the Macintosh's built-in monitor and the connector for the external monitor or projection device. A hole must be drilled in the back of the Macintosh case to allow the external monitor or projection device to be connected to the video connector. Monitors for the Macintosh are *monochrome,* or single color. Although there are currently no reasonably priced color monitors that will produce the resolution required by the Macintosh's video circuits, it is possible that such monitors could appear within the next few years at a price that most users could afford. It is also possible that Apple Computer, Inc. could produce a color Macintosh when such an event occurs. Therefore, some material about color monitors will be presented in this chapter. When such monitors appear, you can use the review and evaluation format at the end of this chapter to evaluate them and to select one.

Because of the graphic nature of the Macintosh screen display, the resolution of the monitor or projection device connected to the Macintosh is very important. Such devices must be able to support the Macintosh's 512- × -342 pixel screen display. There are only a few video connectors for the Macintosh. The video connectors,

the monitors, and the video projection devices that are currently available are described in this chapter.

HOW THE MONITOR WORKS

A monitor is very similar to a television. Its main component is a cathode ray tube (CRT) which acts like the old TV picture tubes. The CRT puts out an electron beam which repeatedly scans the screen from top to bottom in a zigzag fashion, switching on and off. The back of the monochrome screen is coated with phosphorus, which lights up when a beam shines on it. An image is displayed by switching the beam on and off at the right places.

The individual units that make up each scan line are called *pixels*. The more pixels a given monitor generates, the better image is created.

The image is affected by the amount of time the pixels remain on the screen, referred to as the *phosphor persistence*. A short persistence will create a flickering of the characters, while a long persistence will create a ghost image.

The pixels are turned on or lit up by the program you are running. The monitor can only accept this information at a certain rate. This rate is called the *bandwidth* and is measured in MegaHertz (MHz). The greater the bandwidth, the sharper the characters.

MONITOR INTERFACES

The Macintosh's internally mounted monitor is connected to the portion of computer memory reserved for the bit-mapping of the screen display through a series of switching and control circuits. External monitors may also be connected to these circuits by installing a device that allows the signals generated by the computer to be passed to the external monitor as well as the internal monitor. The Macintosh's video circuits allow the image that is stored bit by bit in the portion of the Macintosh's random access memory dedicated to producing a screen image to reach the Macintosh's screen display as electronic signals that are converted to the text or graphics you see on the screen. There is no provision internally in the current versions of the Macintosh for the video signal to be transferred to any video device except the Macintosh's built-in screen display. Most other computers allow or require the video signal to be routed to external devices through a combination of internal video circuits and plug-in video display boards. The only way the Macintosh can send a signal to an external monitor without disconnecting the internal monitor is through a video adapter mounted inside the Macintosh's case. This adapter splits the signal between the internal monitor and the external monitor.

Installation of such adapters is easy for anyone brave enough to open the Macintosh's case. Special screwdrivers and a device to pry off the back of the case are required to open the computer's case. Such tools are being sold by firms advertising in the popular Macintosh magazines. They may also be obtained from local sources with the help of a user's group member or technician familiar with such tools.

Installation of video adapters does not require any soldering. The adapter is mounted on the back of the chassis with two screws. You must drill up to three holes

in the Macintosh's case to accommodate the cable connector that runs from the video adapter to the external monitor and to provide access to adjustment screws on the video adapter's board. The firms that supply such adapters will often make the installation for an added cost. Certified repair centers may also install these adapters.

BUYING TIPS AND TRICKS

After you decide whether you need an external monitor or projection device to allow you to make presentations to large groups, start shopping around for the best quality of image produced. Try to compare the images on two screens side by side, if possible. Next, fill the screen with an image and step back and check the following:

☐ Are the characters all lined up evenly?
☐ Are the vertical columns and the horizontal rows even?
☐ Are the characters at the edges of the screen clear?
☐ When color monitors appear, do the color characters have fringe around their edges?
☐ Is the intensity of the characters equal?
☐ Are the characters in the middle of the screen brighter than those on the edges?
☐ Are there buttons or knobs on the monitor to adjust the contrast, vertical/horizontal lines, and brightness, and to what extent can these be adjusted? (Move the knobs to see.)
☐ If you hold a key down so the cursor moves across the screen, is there a trail after the letter?

When you are looking at a specifications sheet for a monitor, check these items:

☐ How many pixels are there? What is the screen resolution? More pixels equal sharper images.
☐ What is the dot pitch? The smaller the distance, the better the resolution.
☐ What is the bandwidth? The greater the bandwidth, the sharper the image.
☐ What is the phosphor persistence? Do you get flickering characters or ghost characters?
☐ What is the size of the screen? Since the Macintosh along with its built-in screen is portable, you are probably looking for a video device to make presentations to large groups. Such presentations are difficult with the Macintosh's built-in screen display. Nineteen- and 23-inch monitors are currently available for the Macintosh. The smaller of the two sizes is reasonably portable. The larger device is quite awkward and heavy.

Big Mac Monitor $1995.00

Professional Data Systems

RATINGS	FEATURES	
B Overall rating	Type:	Monochrome
A Price/performance	Size:	23″ diagonal
A Ease of installation	Pixel resolution:	800 × 400
C Documentation		
B Vendor support		

PRODUCT SUMMARY

The Big Mac Monitor is a monitor that provides an exceptionally crisp display of the Macintosh's small screen image. It measures 23 inches diagonally and is very good for presentations to groups. This external monitor is connected to the Macintosh via a video adapter that must be installed inside the Macintosh's case. This monitor uses the Macintosh's scanning frequency of 22 kHz to produce an image consisting of an average of 800 × 400 pixels on its screen. The monitor is a white phosphor monochrome device. It offers no sound features.

INTERFACING

The Big Mac Monitor interfaces with the Macintosh through a composite video converter that must be installed inside the Macintosh's case by the user, by the manufacturer at an added cost, or by a technician. Installation of this interface is simple enough that you probably could accomplish the task yourself. This device intercepts the video and timing signals generated by the Macintosh's video circuits. It then combines them into a single composite signal that is directed to the external monitor. The interface card has a connector socket and two adjustment screws mounted on the side that faces the inside of the Macintosh's case. Holes must be drilled in the case using a template supplied by PDS to accommodate the connector and to provide access to the adjustment screws. One adjustment screw is used to horizontally center the image on the external monitor's screen. The second screw is used to adjust the brightness of the image when more than one external monitor is connected in series to the Macintosh.

PERFORMANCE

This product performs extremely well. The image that it produces is very sharp and is flicker-free. It can be seen clearly by groups in typical classroom and auditorium situations.

VENDOR SUPPORT

Professional Data Systems supplies you with adequate documentation to install and operate the Big Mac Monitor. This documentation consists of several mimeographed sheets and a photograph explaining how to install the composite video adapter. A single composite video adapter is supplied with each monitor. The manufacturer warrants all parts and labor for 90 days after purchase. Additional composite video adapters may be purchased for $295.00 from PDS.

Professional Data System's technical staff is available to assist purchasers.

MacMonitor

$788.00

Comtrex International

Video adapter—$188.00

RATINGS

B Overall rating
A Price/performance
C Ease of installation
B Documentation
B Vendor support

FEATURES

Type:	Monochrome
Size:	19″ diagonal
Pixel resolution:	512 × 342

PRODUCT SUMMARY

The MacMonitor (Fig. 9-1) is an inexpensive, external, monochrome monitor for use with the Macintosh. It has a 19-inch screen display and has the proper scan rate to handle the Macintosh's video signals. Before this monitor can be used, a composite video adapter must be installed inside the Macintosh's case. The manufacturer offers such an adapter for an additional $188.00. Such monitors are really useful

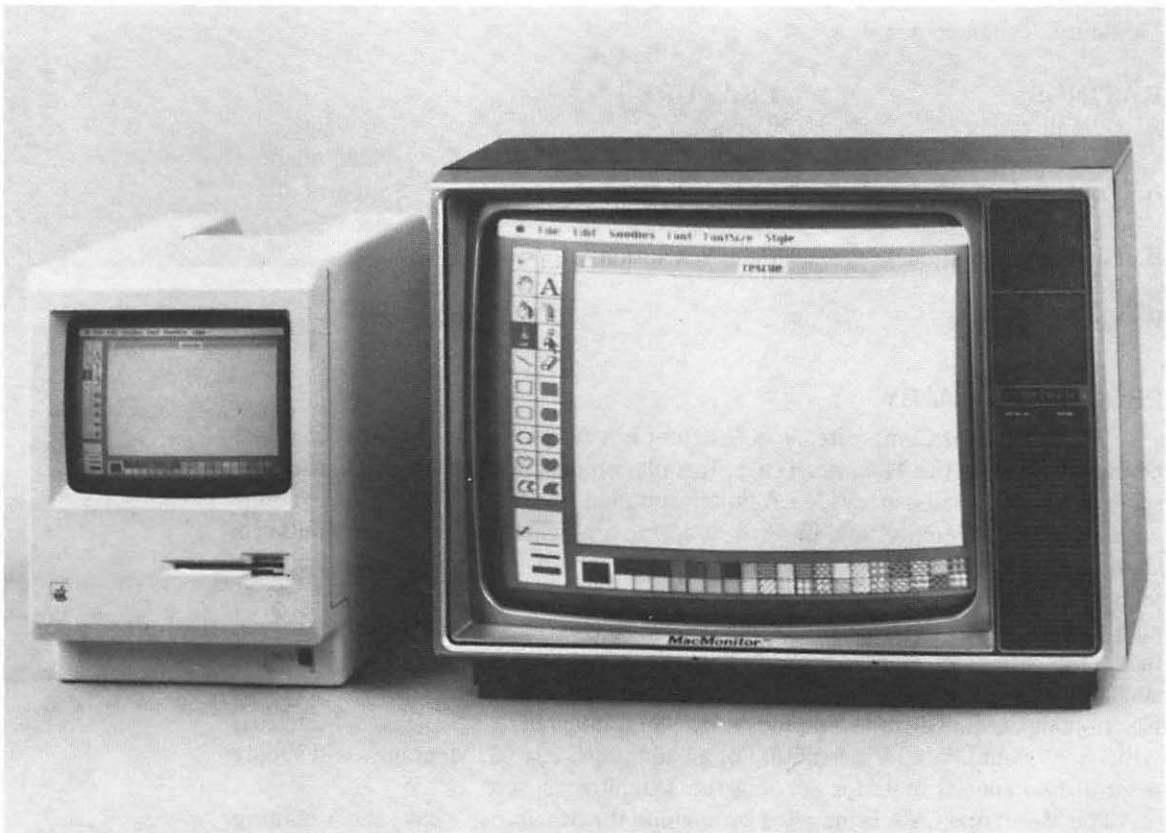

Fig. 9-1. The MacMonitor (courtesy Comtrex Inc.).

for group presentation, classes, user's group meetings, and similar activities which require a larger screen display than the Macintosh's built-in display.

INTERFACING

The MacMonitor cannot be used with a Macintosh unless a composite video adapter is installed inside the Macintosh's case. Installation is easy for anyone who is not afraid to open the case. A hole must be drilled in the back of the case to allow the video adapter to be attached to the monitor.

PERFORMANCE

This product compares in reliability to other such products on the marketplace.

VENDOR SUPPORT

The vendor offers repair support and a warranty with this product.

Mentauris Composite Video Adapter $199.95

Mentauris Technologies

RATINGS	FEATURES	
A Overall rating	Type:	Composite video adapter
A Price/performance	Size:	Supports all sizes
B Ease of installation	Pixel resolution:	
C Documentation		
B Vendor support		

PRODUCT SUMMARY

The Mentauris Composite Video Adapter is a video expansion board that must be installed inside the Macintosh case. Installation is similar to the installation described for the Composite Video Adapter supplied by Professional Data Systems with its Big Mac Monitor and its Project-a-Mac projection system. The Mentauris Composite Video Adapter may be used with a variety of external monitors and projection devices such as those supplied by Professional Data Systems. This video adapter reproduces the frequencies and bandwidths of the Macintosh's video screen in a composite video signal that may be used by external monitors and projectors such as those produced by Arcturus, Aqua-Star, Aydin, Barcodata, Conrac, Eidophor, Electrohome, G.E., Gigatek, Graphicon, Hitachi, Limelight, Magna Image, Monitron, NEC, Sony, and Usatco Videomate. For an additional $24.95, Mentauris will supply a set of two special tools for opening the Macintosh's case.

The Mentauris CVA is installed by opening the Macintosh's case and mounting the video expansion board on the back of the computer's chassis. No soldering is

required. A complete installation manual is supplied with the product. A hole must be drilled in the rear of the Macintosh's case to allow the connection to be made between the monitor and the Macintosh.

WORKSHEET FOR MONITORS

Product $.

Manufacturer

RATINGS	FEATURES
Overall rating	Type:
Price/performance	Size:
Ease of installation	Pixel resolution:
Documentation	
Vendor support	

PRODUCT SUMMARY

INTERFACING

PERFORMANCE

VENDOR SUPPORT

Table 9-1. Comparative Ratings for Monochrome Monitors.

Monitor	Price	Ratings
		1 2 3 4 5
PDS Big Mac Monitor	$1995.00	B A A C B
MacMonitor	788.00	B A C B B
Mentauris Video Adapter	199.95	A A B C B

Key to Ratings
1—Overall rating
2—Price/performance
3—Ease of installation
4—Documentation
5—Vendor support

Table 9-2. Comparative Features for Monochrome Monitors.

Monitor	Features		
	1	2	3
PDS Big Mac Monitor	M	23	650 x 400
MacMonitor	M	19	512 x 342
Mentauris CVA	—	—	—

Key to Features
1—Type (C = Composite, R = RGB, M = Monochrome)
2—Size
3—Pixel resolution

Chapter 10

Video Digitizers

The Macintosh's handling of graphics is where the computer really shines. The speed of the MC68000 chip and the arrangement of the screen display to accommodate very high resolution graphics make the Macintosh an extremely attractive and effective tool for using and producing graphic images. Many of the software applications that have been written for the Macintosh can accept graphics images. MacWrite and Microsoft Word documents can include drawings prepared by MacPaint, MacDraw, MacDraft, and other graphics tools. These applications can also accept images produced by a digitizer. MicroSoft File and FileVision are two examples of database managers that can also accept such images.

Whether we recognize the fact or not, most of us have been exposed to digitized graphic images for many years. A *digitized image* is an image that is produced electronically from signals provided by a camera such as a TV camera or security camera or from an optical scanning device that is moved back and forth over a sheet of paper or other hardcopy. The signals received from the camera are converted to screen images by computer circuits after they have been processed by the digitizer itself. The photographs taken on the surface of Mars, those taken by the satellite that flew past Saturn, and many photographs portraying various aspects of the earth's surface such as vegetation, population concentration, and industrial concentration are produced by digitizing data supplied by video cameras mounted in satellites.

Video digitizers have been available for microcomputers such as the Macintosh for several years. Most of these devices do not produce the excellent image quality supported by the Macintosh because few of these computers have the same number of pixels displayed on the screen as those displayed by the Macintosh. Shortly after

the Macintosh was introduced, two types of digitizers were released for use with the computer. One type of digitizer produces its image from a TV or video camera. This type of device is the most common. The other type of device produces an image from a scan head mounted in the ImageWriter in place of the ribbon cartridge. This device is called an *optical scanner,* while the first device is a *video scanner.*

Each of these device types has its own particular advantages and disadvantages. The printer-mounted scanner is less expensive in terms of overall digitizer system cost than the devices that rely on a video camera to produce the image. This device is not as flexible or as intrinsically portable as the device that relies on the video camera. The optical scanner is limited to items such as documents, photographs, magazine pages, photocopies, and any other materials that can be fed through the ImageWriter.

Video cameras do not usually produce clean, clear images of the types of documents that can be handled by the optical scanner. This particular shortcoming of the video digitizer can be overcome to some degree by mounting the document to be digitized on a flat surface such as an easel and mounting the camera on a tripod with the surface of its lens placed perpendicular to the document to be digitized. Video cameras are the only practical devices for taking pictures of objects and people and converting these pictures directly into digitized images on a computer. To accomplish the same thing with an optical scanner would require that an actual photograph be taken before it could be scanned.

A complete video digitizing system consists of several components. One component is the input device that supplies the image for processing by the digitizer. Input devices include video cameras, VCRs, lens assemblies, and optical scanners. Another component is the digitizer itself. The digitizer converts the image supplied by the input device into a bit-mapped image that the computer can display. In some cases, a second display monitor may be used in addition to the Macintosh's display screen to assist in processing and editing images. Another component of a complete system is the collection of cables and connectors that allows the input device to be connected to the digitizer and the digitizer to be connected to the computer. The final component of a complete system is the software that operates the digitizer, allows the editing of images, allows the transfer of files, and allows the manipulation of images and their shading.

FEATURES

The video digitizers that are on the market for use with the Macintosh have a number of features that set one product apart from the others. All of the video digitizing devices that are available are supplied with software that allows the images produced by the device to be edited and controlled. Most of this software also allows the image to be treated as a MacPaint document by the Macintosh. Many software applications such as Microsoft Word, MacWrite, Microsoft File, and ThinkTank 512 can use images produced by digitizing systems. All such images may be saved on a disk and may be printed out by the software that is supplied or by MacPaint. Some of this software allows gray scales that are very important for

producing high-quality black-and-white images. Most of this software allows images to be sized to suit the user's needs.

Some of the digitizers offered for the Macintosh will accept images from video cassette recorders or from a different computer. Some of these devices are more difficult to connect and to use than others. To some degree, the quality of the image produced by the camera-dependent video digitizer is determined by the quality of the camera that is used to produce the image. This usually means that the more money you spend on a camera, the better the image produced. Thus, a cheap security camera will usually fail to measure up to a high-quality color camera. Some video digitizer systems include the camera to be used with the system. One such system includes a special lens device that is connected to the digitizing system's image processor.

Mac Private Eye

$595.00

I/O Video Inc.

RATINGS	FEATURES	
B Overall rating	Type:	Video digitizer
B Price/performance	Software controls:	Yes
B Software compatibility	Hardware controls:	Yes
A Ease of installation		
B Vendor support		

PRODUCT SUMMARY

Mac Private Eye (Fig. 10-1) is a video digitizer for the Macintosh that accepts images generated by a video camera. It stores the data from these images in a buffer and then displays them on the screen. This method of processing data is really impressive, as it allows an image to be captured in a fraction of a second. Mac Private Eye images cannot be printed directly from the software provided with the digitizer; they must be printed from MacPaint. Images that are larger than the dimensions of the Macintosh screen may be printed.

The digitizer itself is a small box with an external power supply that must be plugged into a power source. A video camera can then be connected to the digitizer which can then be connected to the Macintosh via a serial port. The digitizer has one knob, called the *balance knob,* which is used to adjust both contrast and brightness. Image focus can be controlled from the software provided by the digitizer. An external monitor may be attached to this digitizer although it is really not necessary. There are software controls for lightening the tone of the image, darkening the image, and decreasing contrast. All of these controls help to adjust the quality of an image until the user is satisfied.

Fig. 10-1. The Mac Private Eye digitizing system (courtesy I/O Video, Inc.).

MacVision

$399.00

Koala Technologies Corp.

RATINGS		FEATURES	
A	Overall rating	Type:	Video digitizer
A	Price/performance	Software controls:	Yes
A	Software compatibility	Hardware controls:	Yes
A	Ease of installation		
B	Vendor support		

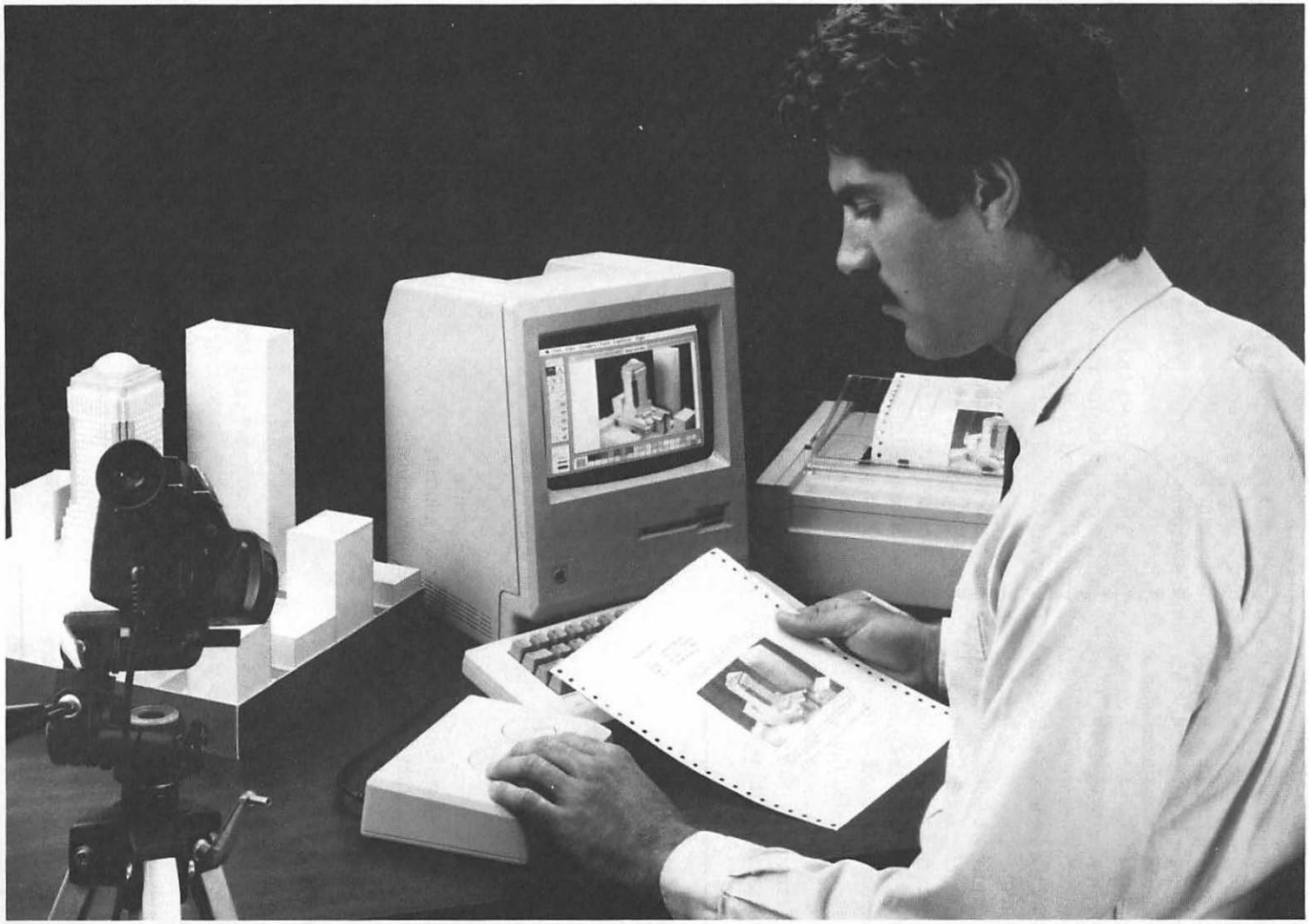

Fig. 10-2. The MacVision digitizing system (courtesy Koala Technologies, Inc.).

PRODUCT SUMMARY

MacVision (Fig. 10-2) is an easy-to-use digitizing system for the Macintosh. It consists of a digitizer that is connected to one of the Macintosh's serial ports. This digitizer can convert input produced by a video camera, a VCR, or a video disc player into images for display on the Macintosh's screen. The input device is connected to the MacVision digitizer with an RCA jack.

MacVision images have excellent quality. The brightness and contrast of these images can be adjusted with two knobs that are inset on the top of the digitizer. These adjustments are reflected in the image displayed on the Macintosh's screen display by the system's software. An image can be produced in about 5 seconds by this system.

The software is installed as a desktop accessory on a disk containing MacPaint, MacWrite, Microsoft Word, Microsoft File, FileVision, or any other software that can use the images. A camera accessory is used to transfer these images from the desktop accessory to the application software. Images that are transferred to MacPaint can be enhanced or touched up by MacPaint. VCR images may be used by MacVision, provided the VCR has a good pause or stop frame mode. MacVision is provided with a complete, concise user's manual and with a system software disk. Koala Technologies Corp., MacVision's manufacturer, has been producing inexpensive but reliable light pens and touch tablets for several years.

Magic

$399.00

New Image Technologies, Inc.

RATINGS		FEATURES	
B	Overall rating	Type:	Video digitizer
B	Price/performance	Software controls:	Yes
A	Software compatibility	Hardware controls:	No
B	Ease of installation	Images per second:	2.5
B	Vendor support		

PRODUCT SUMMARY

The basic Magic digitizing system consists of the video digitizer itself, the cable to connect the digitizer to the Macintosh, and the software to operate the digitizer. New Image Technologies, Inc. will also supply a video camera and a video output jack for attachment to an external monitor. These items are available at an extra charge. Magic can digitize images provided to it by video cameras, VCRs, and video disks. It is connected to the video input device by a standard RCA jack. Because the digitizer is controlled by the software, there are no controls or adjustments available on the digitizer itself.

Software controls and commands are always displayed on the screen instead of making use of pull-down menus. The size and location of Magic's images can

be controlled by the user with the software. Images can take up all or a portion of the display screen. Image shading is controlled with patterns and gray shades available from the software. Brightness and contrast are controlled with scroll bars displayed on the screen. When an image is expanded to fill the screen, its aspect ratio is controlled by pressing the Shift key. Rulers are available on screen to size and measure images. One of the software controls is a pan feature that allows an image larger than the screen to be produced from video disks in particular for further editing and manipulation.

Micro-Imager

$349.95
Video Camera—$175.00
External Monitor—$150.00

Servidyne Micro Systems, Inc.

RATINGS		FEATURES	
B	Overall rating	Type:	Video digitizer
B	Price/performance	Software controls:	Yes
B	Software compatibility	Hardware controls:	Yes
A	Ease of installation		
B	Vendor support		

PRODUCT SUMMARY

The Micro-Imager is a video digitizing system for the Macintosh that consists of the digitizing unit, controlling software, proper cables, an optional black-and-white camera, and an optional external monitor. This digitizer's handling of text is better than any other that we have seen, partially because of the software provided by the manufacturer and partially because of the digitizer itself.

The optional external monitor is important with this digitizer since the system does not reflect changes to adjustments until a scan is completed and displayed on the Macintosh screen. This process takes time and requires that several scans be made before you get a satisfactory final product. With an external monitor, this process is accelerated because this monitor displays the image as it is seen by the camera without performing the scanning and image production required by the Macintosh. Thus, as adjustments to various settings are made by the user, they are reflected on the monitor screen. When settings are right, they can be passed to the Macintosh.

The Micro-Imager can accept input from video cameras, VCRs, and video disc recorders. The documentation provided by Servidyne Micro Systems is the best of all of the digitizers. It is designed to teach the user about the use of the digitizer without slowing down the process of allowing him to use the digitizer.

If an external monitor is being used, the process of focusing is done with the camera itself until a clear image is obtained. Brightness and contrast are then adjusted with knobs on the digitizer itself. Patterns and shading are then manipulated

with the software provided by the manufacturer. Images can be touched up and printed through the software. This particular digitizer is one of the better systems available for the Macintosh.

MicronEye

$395.00

Micron Technology, Inc.

RATINGS		FEATURES	
B	Overall rating	Type:	Video digitizer w/input source
B	Price/performance	Software controls:	Yes
B	Software compatibility	Hardware controls:	Yes
A	Ease of installation		
B	Vendor support		

PRODUCT SUMMARY

The MicronEye video digitizing system consists of a video digitizer (an IS32 OpticRam), an input source (lens connected with a cable to the IS32 OpticRam), a tripod for the lens, and system software. The entire system as just described weighs 2 1/2 pounds. The user may focus the image with the video lens and may set the exposure of the image with either the lens or with the software provided by Micron Technology. The manual provided with this system is adequate. There are no controls on the digitizer itself, although focus adjustments are made on the camera system provided.

One of the software features allows the user to place a miniature of the entire image on the screen. This image is used to reflect any adjustments in focus before translation is made to a full-size image.

The software also allows three types of images to be generated. One type of image is generated by a single exposure. Each of the other types combines several exposures to generate a screen image. One of them produces images with gray scales. The other produces images with pseudo gray scales. Images that are generated by this device may be inverted with the software. The images generated and displayed by this system are smaller than the images generated by any of the other digitizers described in this book. They are about half the size of the Macintosh screen display. A full screen display may be produced by combining an image that is displayed on the upper half of the screen with an image that is displayed on the lower half of the screen. This seems to us to be an unnecessarily complex procedure.

ThunderScan

$229.00

Thunderware

RATINGS		FEATURES	
B	Overall rating	Type:	Optical Scanner
A	Price/performance	Software controls:	Yes
A	Software compatibility	Hardware controls:	Yes
B	Ease of installation		
B	Vendor support		

PRODUCT SUMMARY

ThunderScan is a video digitizing system that relies on an optical scanner mounted in an ImageWriter printer to produce video images on the Macintosh. The system is made up of the scanner, which is attached to the Macintosh's printer port through a switch box that allows the user to switch back and forth between the scanner and the printer, and software that supports the operation of the system.

The optical scanner resembles the ribbon cartridge of the ImageWriter. To mount the scanner, the ImageWriter's ribbon must first be removed. Then the scanner is mounted in the ribbon's place. This scanner requires references to judge when to change direction during the scanning process. These references are provided by attaching white tape to either end of the ImageWriter's platen. The scanner emits light in the red range. This light strikes the document being scanned and then is reflected back into the scanner's lens where it is translated into a signal that the software and Macintosh understands. This signal is then translated into an image that is displayed on the Macintosh's screen.

Documents about as thick as normal printer paper may be fed into the ImageWriter for scanning. As scanning starts, the sensitivity of the scanner is adjusted from the software by selecting the Adjustment feature and then turning a small knob on the top of the scanner. All or a portion of the document may be scanned as directed by the user from the software. Images may be increased or decreased in size by making a software selection.

Images may be saved as ThunderScan or MacPaint documents. The nature of the document as saved determines the software that may be used to edit the image. In some cases, the source document used for input must be photocopied to produce a document that can be handled by the printer or a document that the scanner can handle. If your source document is a photograph, it will probably have to be photocopied and the photocopy will have to be fed through the ImageWriter. If the document contains red or yellow lines, it will have to be photocopied and the photocopy used for scanning because the red light by the scanner cannot be reflected back properly by these documents for the scanner to interpret it.

ThunderScan is one of the least expensive digitizing systems for the Macintosh. It has powerful software tools. The manual is clear and complete. It is easy to follow.

The shortcomings of the system revolve around the ImageWriter. It takes quite

a bit of time to scan a source document, much longer than the scan made by a video camera. While the printer is being used by the scanner, it cannot be used to print. Despite the shortcomings of the system, it is still a good buy and a good product.

WORKSHEET FOR VIDEO DIGITIZERS

Product $.

Manufacturer

RATINGS

Overall rating
Price/performance
Software compatibility
Ease of installation
Vendor support

FEATURES

Type:
Software controls:
Hardware controls:
Images per second:

PRODUCT SUMMARY

Table 10-1. Comparative Ratings for Video Digitizers.

Device	Price	Ratings
		1 2 3 4 5
Mac Private Eye	$595.00	B B B A B
MacVision	399.00	A A A A B
Magic	399.00	B B A B B
Micro-Imager	349.00	B B B A B
Thunderscan	229.00	B A A B B

Key to Ratings

1—Overall rating
2—Price/performance
3—Software compatibility
4—Ease of installation
5—Vendor support

Chapter 11

Disk Drives

Most programs for the Macintosh are stored on 3 1/2-inch disks. For this reason we will only deal with 3 1/2-inch disks and disk drives in this book. We will assume you are familiar with 3 1/2-inch disks containing data and how they are inserted into the disk drive.

A disk drive looks for information randomly. For example, with a disk drive you can go directly to a specific file without having to run through all the files ahead of it on the disk. This feature makes it very efficient and eliminates time spent searching through unwanted material.

A disk is a permanent record of data until it is erased, whereas the computer's random access memory is a temporary record and can be lost when the computer is turned off. Copies of disks are easily made so you will be able to permanently store your information in more than one place.

DISK DRIVE OPERATION

The disk drive must be compatible with your computer. The disk drive performs a number of different jobs, which are controlled and managed either by the finder, Macintosh's Disk Operating System, or a set of programs. Using the finder, the disk drive will store programs or files on a disk, search for and retrieve a particular program or file on a disk, copy a file from a disk, erase material, and keep a directory of the disk's contents.

The directory is a record of a file and its location on the disk. When you want to work with a particular file, select the icon of the desired file or application from

the desktop by double-clicking the icon or by single-clicking the icon using the Open command from the File menu on the menu bar. The disk drive refers to the directory and locates the file for you. After you create a file and write it onto the free space on the disk, it is automatically entered into the directory.

Another function of the disk drive is the preparation of the disk for use, called *initializing* the disk. It prepares the disk to accept certain data structures. Each new disk must be initialized before use. If you initialize a used disk all information on it is erased. Initialization is performed by routines stored in the Macintosh's ROM.

DISKS IN GENERAL

For the purposes of this book and with respect to the Apple, we refer to a 3 1/2-inch plastic square that contains a mylar disk for recording data as a *disk*. It has a hub in the center, a locking device in the upper right-hand corner, and a cover that slides over the disk's read/write slot to protect the storage media. It is made out of mylar and is specially coated with iron-oxide particles, which act as magnets. This magnetic surface is acted upon by the disk drive in recording, transferring, or reading information. The disk itself is enclosed in a plastic cover with an opening that exposes a small part of the disk. This opening is protected by a sliding metal cover. When the disk is inserted and is seated properly inside the disk drive by clamping its hub to a rotating spindle, the disk begins to turn very quickly. The read/write head reads or writes information on the disk through the protected opening in the cover.

Like the grooves on a record, a disk contains tracks to hold information. Some disks are double-sided and information can be recorded on both sides of the disk.

REVIEWS

We have reviewed the drives that are compatible with the Macintosh, and you may judge which model suits your particular needs. When you are looking for a disk drive, consider the number of characters that can be stored on the disk, particularly when comparing single-sided and double-sided drives. One page of single-spaced typing will use up about 4,000 bytes. Also consider the number of files or programs that the disk can store.

Macintosh External Disk Drive

$495.00

Apple Computer, Inc.

RATINGS		FEATURES	
A	Overall rating	Type:	3 1/2" single-sided external
A	Price/performance		
A	Software compatibility		
A	Ease of installation		
B	Documentation		
A	Vendor support		

Haba Disk

$449.00

Haba Systems, Inc.

RATINGS		FEATURES	
B	Overall rating	Type:	3 1/2" single-sided external
A	Price/performance		
A	Software compatibility		
A	Ease of installation		
B	Documentation		
B	Vendor support		

PRODUCT SUMMARY

The Haba Disk is a 3 1/2-inch external disk drive designed for use with the Macintosh. This disk drive connects directly to the Macintosh's disk drive port on the back panel of the computer. It is somewhat narrower and longer than the Apple external disk drive for the Macintosh. The Haba Disk is currently set up as a single-sided 400K-capacity disk drive. Haba Systems was expected to release a double-sided disk drive soon. This disk drive will have 800K of storage capacity and will allow the 400K disk drive to be attached to the system via a connector on the back of the 800K disk drive. This method of connection is called *daisy-chaining*. It will provide the Macintosh user with 1.2 megabytes of external storage if the 800K disk drive is purchased along with the normal 400K disk drive.

The Haba Disk acts like the Apple external drive. The finder treats this disk drive as if it is an Apple external drive. The only annoying features of the Haba Disk are that it is a little noisier than the Apple external drive and it has a tendency to eject disks a little farther than the Apple drive. When the Haba Disk ejects a disk, it ejects almost to the point that it leaves the drive slot. No disks have been completely ejected from the drive, but this characteristic is a little disconcerting.

WORKSHEET FOR DISK DRIVES

Product

$.

Manufacturer

RATINGS

- Overall rating
- Price/performance
- Software compatibility
- Ease of installation
- Documentation
- Vendor support

FEATURES

Type:

PRODUCT SUMMARY

Table 11-1. Comparative Ratings for Disk Drives.

Disk Drive	Type	Price	Ratings
			1 2 3 4 5 6
Apple External Drive	SS	$495.00	A A A A B A
Haba Disk	SS	449.00	B A A A B B

Key to Ratings

1—Overall rating
2—Price/performance
3—Software compatibility
4—Ease of installation
5—Documentation
6—Vendor support

Type

SS—Single-sided
DS—Double-sided

Chapter 12

Hard Disk Drives and Local Area Networks

In this chapter we will discuss both hard disk drives and local area networks. Both are important considerations if you use Macintoshes for your business.

HARD DISK DRIVES

As the number and complexity of the tasks you perform on a Macintosh increase, the storage capacity of the single-sided internal disk drive quickly becomes inadequate. There are at least three good solutions to this problem:

- ☐ Add an external drive.
- ☐ Add a double-sided external disk drive.
- ☐ Add an external or an internal hard disk drive.

There is a great deal to be said for adding a second disk drive. Having the internal Macintosh disk drive along with an external disk drive makes backup simple and fast. It also allows programs that write files to disk during operation to fill up a data disk, which may contain nothing but the data to be stored, rather than filling up the program disk and quickly running out of disk storage space. It also prevents a lot of disk-swapping with programs that are disk-dependent for either their operation or for their files. The removable media effectively increases the available storage because you can swap disks as needed. High-capacity disk drives (double-sided drives) deserve consideration as backup media and for additional, easily changeable storage. They are less expensive than most hard disk systems and offer the benefit

of portable, easily changed storage media. They are usually faster than single-sided disk drives but are much slower than hard disks. When more than about 1 megabyte is needed, or when the faster access of the hard disk is important, hard disk becomes the media of choice. There is a wide variety of hard disk drives available, from 5 to hundreds of megabytes.

Hard Disks

Once you have determined that you have a need for a hard disk instead of, or in addition to, normal or high-capacity disk storage, the problem is to make an intelligent choice among the many hard disks available. The reviews at the end of this chapter will provide some guidance in this complex field.

The prices of hard disks are changing so rapidly you may need to verify the prices before making a decision. Currently, about $200 per megabyte of storage is a good price, and this is expected to decline steadily through the next year or so. Removable media or other special features will, of course, increase this price.

Backup for Hard Disks

Backing up a hard disk is a problem of a different order of magnitude from backing up one 3 1/2-inch disk to another. There are four principal backup methods:

- ☐ Tape cartridges
- ☐ Removable hard disk
- ☐ Double-sided 3 1/2-inch disks
- ☐ Standard 3 1/2-inch disks

The first three strategies are the most effective since they are fast and convenient. In many cases a backup system is incorporated with the hard disk as a single peripheral. All methods, including using existing 3 1/2-inch disks as backup, involve extra expense. Such expense is worthwhile if the data stored on a hard disk is valuable to you. Some hard disk systems restrict you to backing up files on a file by file basis, which is very cumbersome. Others restrict you to backing up files on a volume by volume basis, which is inflexible. A few systems allow files to be backed up only when such files have been modified since the last time a backup was made. The latter is the most efficient of all of the methods.

To back up all 10 megabytes of your hard disk on standard 3 1/2-inch disks will take as many as 20 3 1/2-inch disks if the hard disk is filled with data and programs. This process will take as long as 2 hours, depending on how well organized you have the disks and whether or not any problems such as bad disks or read/write errors occur. It is much wiser to back up only those items which have changed since your last backup, and to maintain a historical file of previous backups. It would still be wise to back up everything on the hard disk occasionally, perhaps once a month, to help to guard against either a disk in your historical files going bad, or the need to search back through an impossibly large stack of disks to accomplish a complete restoration of data and files after experiencing a hardware problem with your hard disk.

It is also wise to practice the backup procedure before you have hard disk troubles. The problems are certain to come at a time when critical tasks are already late and experienced advice is unavailable due to the time of day, weekends, vacations, etc. Do approach, as a matter of practice, any backup/restore session with the greatest possible care and caution, since a possible outcome of errors in the procedure is to lose all files and data involved.

In addition to having backup copies of files and programs on disks ready to restore to the hard disk, it would also be prudent to have a contingency plan that would allow at least the most critical functions performed by your computer to proceed without the hard disk. If files too large to fit on the 3 1/2-inch disks are essential to your operation, your only option may be to have a backup hard disk or double-sided disk drive, or to take the risk of your computer being down for some period of time. Another alternative is to have a backup site which will make computer time on a system comparable to yours available to tide you over a hardware emergency. If you take this route, be sure to try it before you depend on it. Be aware also that changes in the backup system could render it incompatible with your application. For many systems, a stripped-down version can be run on disks, provided you plan for it in advance as part of your software organization and development effort. This method is particularly effective with double-sided disks.

Manufacturers Versus Packages

Some of the companies offering add-on hard disks for the Macintosh do not manufacture the actual hard disk drives. The actual manufacturers tend to produce a generic drive adaptable to various computers and leave the problems of packaging the drives with software, documentation, cables, box, power supply, etc. to other companies. Although this is the general rule, there are exceptions, such as Corvus which both manufactures and packages its drives for the consumer. Since the serviceability of a hard disk depends on the entire package of drive, power supply, software, documentation, etc., we have concentrated on reviewing the final package. Many packages use raw drives from as many as half a dozen different drive manufacturers interchangeably, and the list of raw drive suppliers will change from time to time. We have indicated the manufacturers of the underlying raw drives wherever they are available.

LOCAL AREA NETWORKS

A *local area network*, or LAN, is several computers that share a hard disk, printers, and other peripherals, and can access shared data. For most business users it is shared access to data that makes networks desirable. A company may well be able to afford a hard disk and printer for every Macintosh. The problem revolves around having updates, changes, and other up-to-date data available not just to the particular Macintosh where the data was entered, but also to other Macintoshes in the same office.

While it is not impossible to approach this problem by copying files from one machine to another, there are many serious problems with this approach. When several people need to simultaneously update and inquire against the same files,

a network is the only realistic solution. Some networks also support communications between the computer users of linked systems through electronic mail. Such network features are often sought by business users.

Although some businesses will see reducing the number of hard disks and fast or letter-quality printers required for an office as a minor side effect of linking computers into networks, others, especially home users and schools with multiple computers, will see sharing one hard disk and one printer between several computers as the main advantage of networking. Small business users and individual departments within large businesses may gain efficiency from forming microcomputers into networks that share the same hard disk system, the same files, and the same high-quality printer. From either perspective, the real question is which of the several hardware and software systems currently available for networking Macintoshes offers the features and price/performance value that fits your needs best.

What to Look for in a Local Area Network

The best network will depend as much or more on your specific situation and needs than on the characteristics of the networks. This is a rapidly changing area, and there can be no substitute for reading the reviews published in major magazines as new LANs appear and consulting a retailer who supports several networks.

One major feature you will want to especially look for if you plan a small network is whether all Macintoshes can be used for applications work. Many networks require that one Macintosh be dedicated to running the hard disk. This dedicated Macintosh, often called a *file server* or *disk server*, cannot be used to run your applications. In these systems, if you need three Macintosh workstations, you will need four computers. While these systems may provide enough increase in speed on large networks to justify the cost of an extra Macintosh, in most small networks, the work load on the network is so low that a dedicated disk server would not provide a significant increase in the speed of data transfer.

The hard disk systems and LANs used with the Macintosh should use the AppleTalk system and the AppleTalk connectors produced by Apple Computer. They should all use a *finder*, or disk operating system, that is compatible with the Macintosh finder.

The only sure test is to try out the network or have it selected and installed by a specialist in networking, possibly the retailer for the network.

Cost Comparisons for LANs

The cost of a network depends on the network overhead, which largely consists of the dedicated disk server where one is required, and the per workstation cost. Per workstation (or per node) cost includes how much it costs for any device used to control interaction with file storage, how much it costs for a file storage device, how much it costs to control software, and how much it costs to connect the devices in the network together. The Features table for each network reflects approximate prices in effect when we reviewed the networks and are meant as a rough guide only. Since prices are subject to rapid change in this fledgling field, checking the latest prices and changed features is the only prudent course.

Fig. 12-1. The Bernoulli Box (courtesy IOMEGA Corp.).

Many other factors should go into the final selection of a LAN, just as with any hardware acquisition decision. Availability of trained personnel, retailer and manufacturer location and support, and compatibility with existing hardware and software are among these factors. In any particular case there will certainly be others. We hope this overview of local area networks will give you some perspective on the problems and potential solutions.

REVIEWS OF HARD DISKS

The Bernoulli Box

$1995.00

IOMEGA Corporation

RATINGS

A Overall rating
B Price/performance
A Ease of installation
A Documentation
B Vendor support

FEATURES

Type: Removable cartridge

PRODUCT SUMMARY

The Bernoulli Box (Fig. 12-1) is a 5-megabyte high-density storage device that uses cartridges containing the same medium as a floppy disk to store data. These cartridges can be removed from the drive and can be shipped or carried to any other location that uses a Bernoulli Box. The second Bernoulli Box can read the cartridge written by the first Bernoulli Box.

The storage medium used in the Bernoulli Box is less expensive than the medium used in Winchester hard disk systems (an aluminum-alloy disk coated with magnetically sensitive material). The storage medium contained in the Bernoulli Box is rotated at extremely high speed over a rigid surface. The speed of rotation and the proximity to the rigid surface causes the medium to "fly" over the surface in a very stable manner.

The data transfer rate between the Bernoulli Box and the Macintosh is 90 kilobytes per second. Average access time to read a file or write to a file is 50 milliseconds. The Bernoulli Box itself measures 5.1 inches in height, 10.7 inches in width, and 12.5 inches in depth. Installation is extremely easy with a Macintosh.

Hyperdrive

$2795.00

General Computer Company

RATINGS

A Overall rating

FEATURES

Type: Internal, fixed 3 1/2"

RATINGS

A Price/performance
C Ease of installation
A Documentation
B Vendor support

PRODUCT SUMMARY

The Hyperdrive is a fixed hard disk system that is mounted inside the Macintosh's case. This hard disk system offers the user 10 megabytes of data storage. It cannot be installed by the normal user, but may be installed by technicians at many authorized Macintosh service facilities. If you do not already have a 512K Macintosh, you must have your Macintosh upgraded to 512K, since the system requires a 512K Macintosh to operate properly. The upgrade to 512K is included in the cost just stated.

Access times to and from the Hyperdrive are about 20 times faster than access times with external disk drives. They are about 7 times faster than external hard disk access times. The Hyperdrive uses none of the Macintosh's serial ports since it is installed internally.

The operating software provided with the Hyperdrive allows you to partition the storage medium into 32 separate file drawers. Each file drawer may be resized. Each drawer may have a user-specified security access to prevent unauthorized personnel from accessing critical data. The current Macintosh finder allows about 1000 files within each partitioned volume of a hard disk to be controlled and logged in a directory for a 512K system. Although this number of files can be controlled by the finder, it is very slow when the number of files exceeds 500. Therefore the operating system for the Hyperdrive allows you to set up each volume for 128, 256, or 512 files per volume. Partitioning the disk into separate volumes that may be mounted and unmounted as needed allows the Macintosh's finder to maintain a high speed of file access that wouldn't be available if the operating system did not allow partitioning.

The Hyperdrive is booted automatically when the Macintosh is turned on. None of the other hard disk systems described in this book boot automatically. They require a special system disk to make the hard disk available to the user. The Hyperdrive operating system allows the user to select a particular volume to be booted when the computer is turned on. Backup of hard disk files may be made file by file, which allows the user to transfer the backup of any single file that may have been changed rather than requiring the user to copy a whole volume, in an Incremental Backup mode that backs up only those files that have been changed or modified since the last time the volume was backed up, or in a full backup of whole volumes.

One great advantage of the Hyperdrive is its internal mounting within the Macintosh's case. This installation keeps all of the Macintosh's ports free for use. It also makes the whole system, including the hard disk, as transportable as the original Macintosh. All external drives add one more piece of equipment that must be lugged around any time you want to transport your entire system.

The Keeper

SQ-5FM—$2295.00
SQ-55FM—$3595.00
SQ-510FM—$3595.00
PRO-10FM—$2295.00
PRO-20FM—$2695.00
PRO-30FM—$3295.00

Micro-Design

RATINGS

A Overall rating

A Price/performance
A Ease of installation
B Documentation
B Vendor support

FEATURES

Type: Removable (SQ series) or fixed (PRO series)

PRODUCT SUMMARY

The Micro-Design products listed here offer you a variety of hard disk and LAN configurations that use the AppleTalk network to interface between the Macintosh and the mass storage device. The SQ-5FM is a 5-megabyte externally connected hard disk drive with a removable formatted medium. The SQ-55FM is a hard disk system that includes two 5-megabyte hard disks with removable formatted media mounted in a single case. The SQ-510FM hard disk system includes a 5-megabyte removable hard disk mounted in the same case as a 10-megabyte fixed hard disk drive. Both of these hard disks are already formatted.

The PRO-10FM is a 10-megabyte formatted fixed hard disk system. The PRO-20FM is a 20-megabyte formatted fixed hard disk system. The PRO-30FM is a 30-megabyte formatted fixed hard disk system.

Removable cartridges for the SQ systems cost $85.00 each. The user benefits from removable storage media by having convenient expansion of data storage, ease of backup, and the security of being able to remove any cartridge that contains sensitive data.

All of the systems that are used by the Macintosh can also act as file servers and printer servers for up to 32 Macintoshes in a LAN. These devices are controlled through 256K of built-in cache memory and by software that allows files to be accessed by more than one Macintosh.

Macbottom

$1995.00

Personal Computer Peripherals Corporation

RATINGS

A Overall rating

FEATURES

Type: Removable

RATINGS

B Price/performance
A Ease of installation
A Documentation
A Vendor support

PRODUCT SUMMARY

Macbottom is a 10-megabyte fixed hard disk system designed to fit under the Macintosh on a desktop. This hard disk system is 2.0 inches high, 9.7 inches wide, and 9.5 inches deep. It provides 10.7 megabytes of hard disk storage. It weighs a little more than 5 pounds.

The operating system for this hard disk allows its memory to be partitioned into a number of volumes. This type of operating system allows you to overcome the limits of the current Macintosh finder, which allows you to keep track of about 120 filenames before it announces that "The Desktop is full" and does not allow further control of file storage without removing items from the desktop.

This device has been set up in such a manner that allows it to be turned on at the same time that the Macintosh is turned on. In this way, you save power by ensuring that the hard disk only runs as long as the Macintosh is running. Some hard disk users forget to turn off the hard disk when they turn off the Macintosh.

Macbottom provides the user with a printer spooler by allowing the hard disk to be connected through the Macintosh's printer port. A printer spooler uses part of the hard disk's memory to stage data moving between the computer and the printer. Since data moves between the computer and the printer faster than the printer actually prints, the process of printing actually slows down the transfer rate to the speed of printing unless you have installed a printer buffer or a printer spooler between the computer and the printer. Once such a device has been installed, data is transferred until the buffer's memory or the memory set aside for the spooler is full. Most documents don't use all of this memory. Therefore, as soon as the document has been staged in the buffer's memory or in the spooler, the computer is available for other things. The buffer and the spooler then feed the printer until the document has been completely printed.

MacDrive

5R—$1995.00
10—$1995.00
10 + 5R—$3290.00
Tecmar 5R + 5R—$3290.00

RATINGS

A Overall rating
A Price/performance
A Ease of installation

FEATURES

Type: Removable or fixed

RATINGS

B Documentation
B Vendor support

PRODUCT SUMMARY

Tecmar produces four hard disk storage systems for the Macintosh: the Tecmar MacDrive 5R, the Tecmar MacDrive 10, the Tecmar MacDrive 5R + 5R, and the Tecmar MacDrive 10 + 5R. The 5R is a 5-megabyte removable media hard disk drive. The MacDrive 10 is a 10-megabyte fixed hard disk system. The 10 + 5R combines the 10-megabyte fixed system with a 5-megabyte removable system. The 5R + 5R system combines two removable cartridge 5-megabyte hard disk systems.

Tecmar's hard disk system is durable and reliable. The removable cartridge systems increase flexibility by allowing you to transport or send cartridges from one place to another for use on another Tecmar removable cartridge system. All of the MacDrive systems are supplied with software that allows you to partition the hard disk into several volumes. MacDrives are connected to the Macintosh through either the modem port or the printer port. They may be used to spool documents being sent to the printer from the Macintosh, so the computer is not bound by the speed of the printer during the printing process.

The Tecmar hard disk systems must be booted from a floppy disk when the Macintosh is turned on. The Tecmar operating system allows the hard disk to be partitioned into a number of volumes, each containing about 256 files. There are no diagnostic utilities provided as part of Tecmar's operating system, and no startup volume may be selected. The only backup facility offered is a file-by-file backup.

OmniDrive

$1995.00

Corvus Systems, Inc.

RATINGS

A Overall rating
B Price/performance
A Ease of installation
A Documentation
A Vendor support

FEATURES

Type: Fixed

PRODUCT SUMMARY

The Corvus OmniDrive offers a combination hard disk and Omninet network service. The disk drive is manufactured by Corvus, a rarity in the hard disk field which tends toward separate manufacturers and packages. The Corvus drives are relatively expensive, with much of the extra cost reflecting the networking features. If you are not definitely planning an OmniNet networked system, it will be hard to justify the prices of the drives in spite of their excellent performance characteristics. Large OmniDrives are available as follows:

11MB—$2495.00
16MB—$3915.00
45MB—$4995.00

The Bank, a 200MB freestanding random access backup unit, is available for $2195. Cartridges for it are $70 for 100MB and $100 for 200MB. All of Corvus' products have excellent service and support reputations. We found these drives easy to install and use. The drives are covered by a 1-year warranty. Provided you plan to expand into an OmniNet system, these are excellent drives.

Considered as drives only, they are not cost-competitive with other drives. Note too, that building a network once you have an OmniDrive may still cost as much per workstation as other networks which do not require special drives, provided the other network does not tie up a Macintosh as a file server. That is the chief value of the OmniDrive: it fills a network role that ties up a complete Macintosh with hard disk in some other networks.

Corvus hard disk systems may be partitioned into 10 volumes. Each volume may be sized at 800K, 1600K, 3200K, or 6400K in any combination allowed by the storage space of the particular hard disk system you purchase. Each volume may contain about 256 files. A particular volume may be selected as a startup volume. This volume is booted automatically each time the hard disk system started. A startup disk must be used to access the hard disk system each time the Macintosh is turned on. The only backup facility that is available on this system is a volume-by-volume backup.

Paradise Mac 10

$1495.00

Paradise Systems, Inc.

RATINGS

A Overall rating
B Price/performance
A Ease of installation
B Documentation
B Vendor support

FEATURES

Type: Fixed

PRODUCT SUMMARY

The Paradise Mac 10 hard disk system (Figs. 12-2 and 12-3) for the Macintosh is an extremely compact device that takes up very little space next to the Macintosh. The storage medium rotates at 3600 rpm. This device is connected to the Macintosh via one of the serial ports and includes its own serial port to allow you to attach your printer or modem. The Paradise Mac 10 uses part of its memory as a print spooler.

The Paradise Mac 10 is 5.5 inches high, 3.5 inches wide, and 10.8 inches deep. It weighs 5 pounds. The operating system that is provided with this device uses the Macintosh desktop presentation and Macintosh user interface to make you comfortable with file maintenance and other tasks associated with using the system.

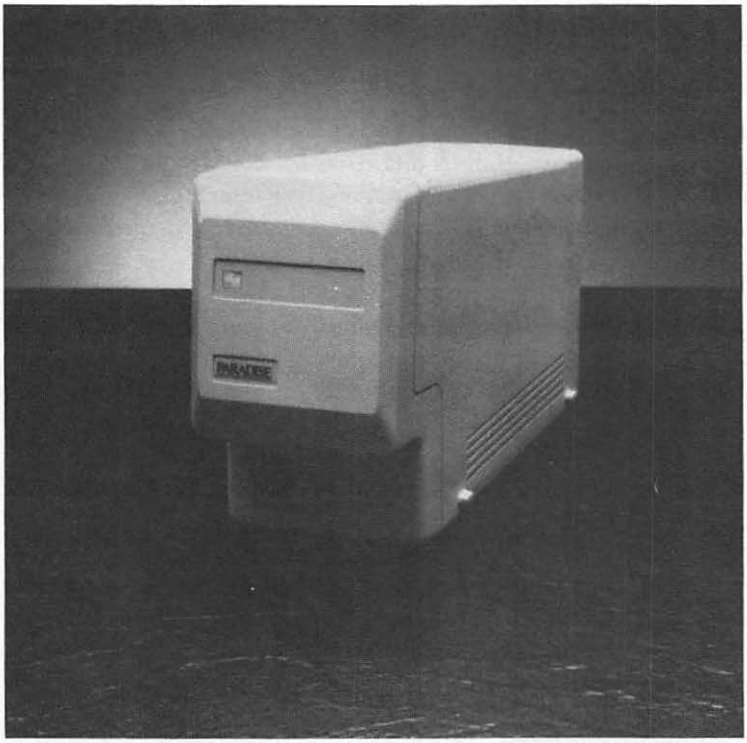

Fig. 12-2. The Paradise Mac 10 hard disk (courtesy Paradise Systems Inc.).

Fig. 12-3. The Paradise Mac 10 hard disk and the Macintosh (courtesy Paradise Systems Inc.).

QC10 $1995.00

Quark

RATINGS		FEATURES
A	Overall rating	Type: Fixed
A	Price/performance	
A	Ease of installation	
B	Documentation	
A	Vendor support	

PRODUCT SUMMARY

The Quark QC10, which works with the Apple II, II+, *IIe*, and *IIc*, and the Macintosh, features 10 megabytes of formatted fixed-media hard disk storage. It can handle a number of different operating systems in the Apple II family environment with a different sized portion of the disk for each of the operating system's files. It can even have different portions of the disk reserved for a *IIe*, *IIc*, and Macintosh. The user sets switches on the disk to show which type of machine is using the QC10.

You have several levels of password protection on the various portions of the disk. Some areas of the disk may not be accessed without a password. Other areas can require a password to write or modify files in that area but not to read files.

The QC10 connects to the external disk drive port on the back of the Macintosh and provides another external floppy port on its back. This connection system is particularly advantageous to the Macintosh user since it provides faster access speed than that provided via a serial port. The user may also connect his 400K or 800K external disk drive to his system, which increases the mass storage and the flexibility of its use immensely.

The operating system supplied with this hard disk system allows partitioning of hard disk space into several volumes. This operating system overcomes the limitations of the original Macintosh finder, which uses a flat file method.

REVIEWS OF LOCAL AREA NETWORKS

AppleTalk $50.00

Apple Computer, Inc.

RATINGS		FEATURES	
A	Overall rating	Cost per workstation:	$50.00
A	Price/performance	3 workstations	$150.00
A	Ease of installation	5 workstations	$250.00
A	Documentation	10 workstations	$500.00
A	Vendor support	20 workstations	$1000.00
		Max number workstations:	32 nodes
		Dedicated file server:	None supplied

PRODUCT SUMMARY

The AppleTalk network (Fig. 12-4) was introduced at Apple Computer, Inc.'s shareholder's meeting in 1985. It consists of connectors that take advantage of the Macintosh's built-in circuits and software included with the system that was released in Spring 1985 to link up to 32 nodes together into a network. This network can include 128K Macintoshes, 512K Macintoshes, Macintosh XLs, Apple IIs, Apple *II*es, Apple *II*cs, a LaserWriter printer, file servers, hard disks, and even IBM PC computers.

The AppleTalk network may be used by a specially designed Bernoulli Box hard disk system or Micro-Design's Keeper systems, and will be included with other systems yet to be released.

The Keeper

$3295.00

Micro-Design

RATINGS		FEATURES	
A	Overall rating	Cost per workstation:	$159 @ 30ws
A	Price/performance	3 workstations	$1148
A	Ease of installation	5 workstations	$709
B	Documentation	10 workstations	$380
B	Vendor support	20 workstations	$215
		Max number workstations:	31
		Dedicated file server:	Y

PRODUCT SUMMARY

The Keeper is described in more detail in the section on hard disk drives. This hard disk system can act as both a file server and print server for a network of Macintoshes. A *file server* is a piece of software that allows a computer or several computers to find, retrieve, and save data from the same set of files. It does not restrict a user to only those files opened by his computer; instead, it allows a number of users to access the same files. The Keeper's system allows up to 2000 files to be set up in each volume. Multiple volumes can be open at the same time with a 128K or 512K Macintosh. Password protection is available from this system to protect sensitive files.

The Keeper can be linked with up to 31 other pieces of equipment with the AppleTalk network. These pieces of equipment may include multiple Keepers, LaserWriters, and Macintoshes. Since the Keeper acts as a file server, no Macintosh in the system is required to be used in this fashion. The cost per station computed is based upon a system made up of one Keeper, one Laserwriter, and 30 Macintoshes.

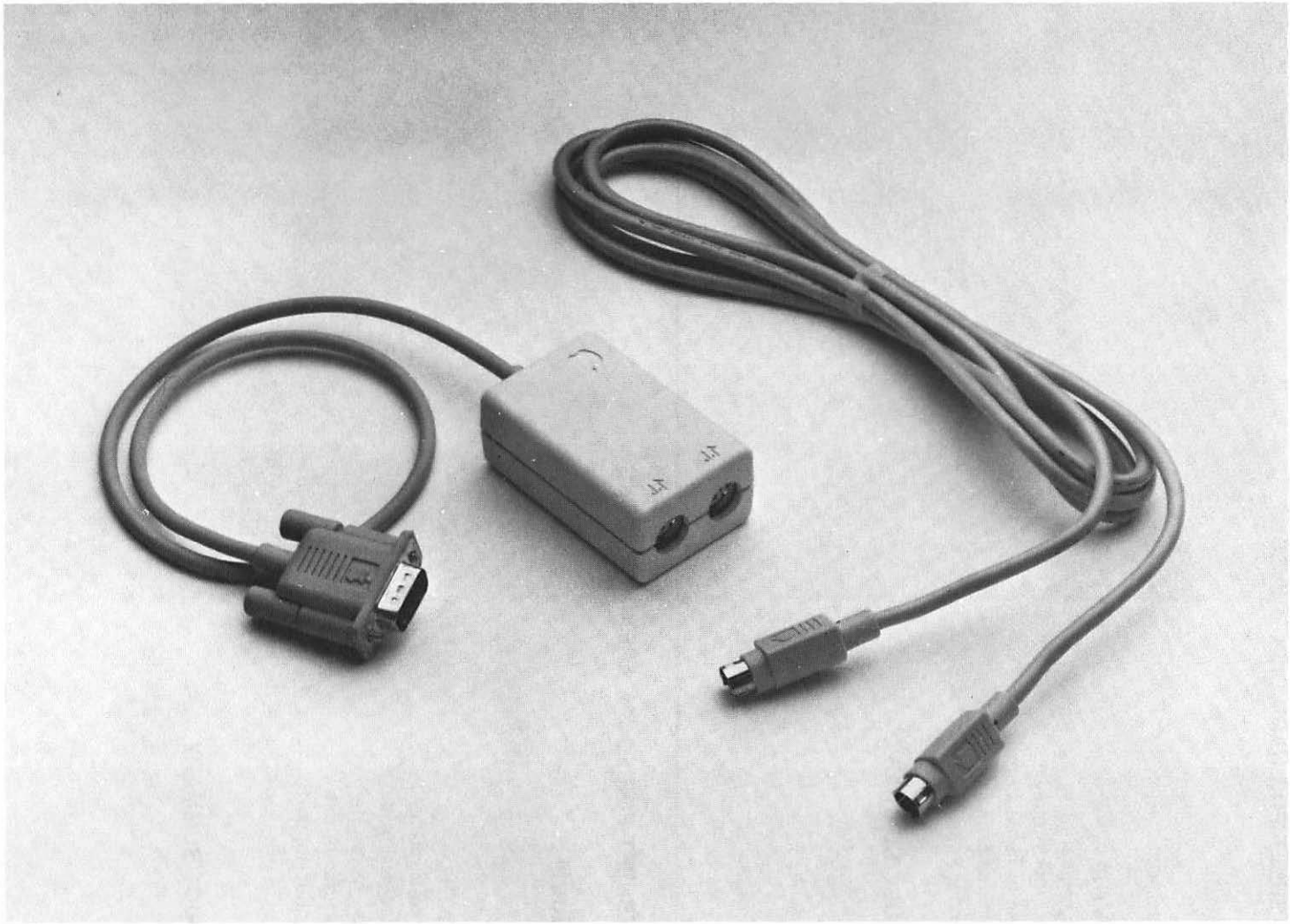

Fig. 12-4. The AppleTalk Personal Network hardware (courtesy Apple Computer, Inc.).

WORKSHEET FOR HARD DISK DRIVES

Product $.

Manufacturer

RATINGS
- Overall rating
- Price/performance
- Ease of installation
- Documentation
- Vendor support

FEATURES

Type:

PRODUCT SUMMARY

WORKSHEET FOR LOCAL AREA NETWORKS

Product $.

Manufacturer

RATINGS
- Overall rating
- Price/performance
- Ease of installation
- Documentation
- Vendor support

FEATURES

Cost per workstation:

3 workstations	$
5 workstations	$
10 workstations	$
20 workstations	$

Max number workstations:

Dedicated file server:

PRODUCT SUMMARY

Table 12-1. Comparative Ratings for Hard Disk Drives.

Disk Drive	Price	Ratings				
		1	2	3	4	5
Bernoulli Box	$1995.00	A	B	A	A	B
Hyperdrive	2795.00	A	A	C	A	B
Keeper SQ-5FM	2295.00	A	A	A	B	B
Keeper SQ-55FM	3295.00	A	A	A	B	B
Keeper SQ-510FM	3595.00	A	A	A	B	B
Keeper PRO-10FM	2295.00	A	A	A	B	B
Keeper PRO-20FM	2695.00	A	A	A	B	B
Keeper PRO-30FM	3295.00	A	A	A	B	B
Macbottom	1995.00	A	B	A	A	A
MacDrive 5R	1995.00	A	A	A	B	B
MacDrive 10	1995.00	A	A	A	B	B
MacDrive 10 + 5R	3290.00	A	A	A	B	B
MacDrive 5R + 5R	3290.00	A	A	A	B	B
OmniDrive 11	2495.00	A	B	A	A	A
OmniDrive 16	3195.00	A	B	A	A	A
OmniDrive 45	4995.00	A	B	A	A	A
Paradise Mac 10	1495.00	A	B	A	B	B
Quark QC10	1995.00	A	A	A	B	A

Key to Ratings
1—Overall rating
2—Price/performance
3—Ease of installation
4—Documentation
5—Vendor support

Table 12-2. Comparative Ratings for Local Area Networks.

LAN		Ratings					
		1	2	3	4	5
AppleTalk Personal Network	$50.00	A	A	A	A	A
Keeper PRO-30FM	3295.00	A	A	A	B	B

Key to Ratings
1 - Overall rating
2 - Price/performance
3 - Ease of installation
4 - Documentation
5 - Vendor support

Table 12-3. Comparative Features for Local Area Networks.

LAN	Features					
	1	2	3	4	5	6
AppleTalk	$150.00	$300.00	$500.00	$1000.00	32	N
Keeper PRO30M	1148.00	709.00	380.00	295.00	31	Y

Key to Features
1 - Cost per workstation (3)
2 - Cost per workstation (5)
3 - Cost per workstation (10)
4 - Cost per workstation (20)
5 - Maximum number of workstations
6 - Dedicated file server

Chapter 13

Memory Expansion

Anyone who bought a 128K Macintosh and many people who bought 512K Macintoshes have discovered that they either require or desire more random access memory than the computer offers. The Macintosh's RAM can only be expanded by opening the computer's case and either replacing the computer's digital motherboard that lies horizontally under the main part of the computer's chassis or by replacing selected chips on this board. The digital motherboard is the heart of the computer. It contains the central processing unit (CPU) chip (the Motorola MC68000), the Integrated Woz Machine disk drive controller chip, the array of dynamic memory storage chips (RAM), the array of read-only memory chips that contains the user interface toolbox and other system control routines, system timing and control chips, memory access control chips, serial control chips, video registers, and the connectors used to attach peripherals to the Macintosh. This circuit board is very important to the function of the computer itself and is important to the connection of the computer to external devices such as disk drives, printers, modems, the mouse, and external sound devices.

Memory expansion can be used in one of two ways. It can be additional RAM in which the computer can store part or all of a program or the data being used by the program. The expanded RAM can function as a RAM disk, meaning that the extra memory is not considered by the application in use on the computer as part of the expanded memory of the computer, but as a disk drive. Programs and data are normally stored on the disks prior to being loaded into the computer's memory. In order to be used by the computer, they must first be read into the main memory from the disk. With a mechanical storage device such as a disk drive, the speed of

loading and the speed of access to data on a disk is limited by the mechanical characteristics of the disk drive and the nature of control sequences used by the disk drive controller device used by the computer's designers. Since a RAM disk is really in the computer's memory, the speed of access is no longer dependent upon mechanical considerations. All interaction between the program and its data proceeds at electronic rather than mechanical speed. A RAM disk is between 3 and 10 times faster than regular disk drive in transferring data.

RAM only maintains the data in it as long as electrical power is applied to the chips. Because RAM chips need electrical power to maintain their memory, any program or data stored in there is lost if power is lost. If you use a RAM disk, remember to transfer the data contained in there to a regular disk or to hard disk storage prior to turning off the computer.

MACINTOSH MEMORY UPGRADES

A variety of upgrades are available for the owners of 128K Macintosh computers and 512K Macintosh computers. Apple Computer, Inc. offers memory upgrades from 128K to 512K. These upgrades are performed by authorized Apple service facilities. When upgrades are performed for Apple by authorized facilities, you can be sure that the upgrade is performed with Apple parts and strictly according to Apple specifications by properly trained personnel. Apple also warrants the expansion parts for 90 days. If the warranty on your 128K Macintosh has not expired, this warranty is continued after the upgrade is completed.

Many independent sources also offer memory upgrades for the Macintosh. Many of them will warrant their work for 90 days or more; however, Apple will not continue an existing warranty on a 128K Macintosh if the case has been opened by anyone except an Apple-authorized repair facility. Thus, warranty work on other parts of the computer that fail may not be carried out by an authorized repair facility if you have the upgrade done by anyone other than an Apple-authorized facility. If your warranty has already expired, this consideration is not really all that important and you might as well look for the best possible price from a reputable memory expansion firm.

The review material at the end of this chapter lists a few of the memory expansion services for the Macintosh. Others may be advertised in your area. You should not have work done by any such firm until you consult others who have had a memory upgrade performed by them. A local user's group or an electronic bulletin board is the best place to find out who is reliable and who isn't.

If you are really brave and have some experience with soldering and other electronic assembly work, you may wish to upgrade your Macintosh's memory yourself. The January, 1985, issue of *Dr. Dobbs Journal* contains an excellent article entitled "Fatten Your Mac" by Tom LaFleur and Susan Raab. This article describes the components and tools that are required to expand the Mac's memory yourself. It leads you through the process step by step with cautions and warnings wherever they are required.

A number of manufacturers are offering Macintosh memory upgrade kits to anyone brave enough to undertake the task. Kits are less expensive than upgrades performed by others. The instructions that accompany a kit must be complete and

well illustrated to ensure the upgrade can be performed properly. The disadvantage of a kit is that the manufacturer will only warranty the parts. Many users do not have the proper tools, skills, and knowledge to attempt a kit type of upgrade.

BEYOND THE 512K MACINTOSH

If you use large spreadsheet applications, if you wish to use more than five applications in memory at the same time, or if you work with a large database that resides entirely in memory, you may wish to expand the Macintosh's RAM beyond 512K to 1 or 2 megabytes. Apple Computer, Inc. may be offering such an upgrade. A number of independent sources offer such upgrades now. These upgrades are subject to the comments just offered regarding upgrades to 512K.

There is one other very important consideration when you are thinking about expansion beyond 512K. The ROM programs in the Macintosh specify that the memory space dedicated to producing screen images will be the highest portion of the Macintosh's random access memory. It does not allow this portion of memory to be relocated. This means that upgrades beyond 512K of RAM with the original Apple ROM are unable to treat the entire memory as a contiguous (unbroken) unit. Instead, if the upgrade is performed and the ROM chips are not replaced or if software is not provided to bypass this situation, the entire memory made available through the upgrade cannot be used by applications. Instead, the second 512K or added 1.5 megabytes of memory can only be used as a RAM disk.

Bech Tech takes advantage of this situation by making the additional memory a RAM disk called the Electric Disk. This RAM disk is located in the upper 512K of RAM on a 1-megabyte Macintosh. If the system crashes or if the Reset switch is pressed, anything that is stored in the Electric Disk is not lost. When the system is restarted by placing the controlling disk for the Electric Disk into the Macintosh's disk drive, the RAM disk is recognized and its contents are made available to you. It is not described in detail as little information was available to us. If you purchase an upgrade to increase the RAM of your Macintosh beyond 512K, and you want to use all available memory for applications, make sure the upgrade provides contiguous memory access to all applications. If you wish to have the protection of a device such as the Electric Disk, find out if this protection is offered by the firm that performs the memory expansion you are considering.

Apple Memory Upgrade

512K—$700.00

Apple Computer, Inc.

RATINGS		FEATURES	
B	Overall rating	ADDITIONAL software:	+
B	Price/performance	90 day warranty:	+
A	Software compatibility	Does not void warranty:	+
C	Ease of installation	RAM disk software included:	–
D	Documentation		
A	Vendor support		

PRODUCT SUMMARY

Apple Computer's memory upgrade from 128K to 512K is the only upgrade except the upgrade included with the installation of the Hyperdrive hard disk system that does not void the Apple warranty on the Macintosh. This upgrade is performed at any Apple-authorized repair facility. The upgrade is accomplished by swapping out the digital motherboard with 128K of RAM and swapping in a new digital motherboard with 512K of RAM. This upgrade is one of the most expensive available for the Macintosh. It is occasionally discounted; so you may wish to shop around for a facility that will do the work for less than $700. Apple Computer warrants the work on this upgrade for 90 days. It is also covered under the AppleCare maintenance program offered by many dealers. MacTerminal or MacDraw are often offered along with the upgrade for no additional cost.

Centa 512K Upgrade

$350.00

Centa Systems Inc.

RATINGS		FEATURES	
B	Overall rating	Additional software:	–
B	Price/performance	90-day warranty:	+
B	Software compatibility	Does not void warranty:	–
C	Ease of installation	RAM disk software included:	+
C	Documentation		
B	Vendor support		

PRODUCT SUMMARY

The Centa Systems upgrade to 512K is performed by members of the Centa staff. Arrangements must be made to ship your Macintosh to them unless they happen to be in town for a computer show. The upgrades performed by this firm are functionally and electronically the same as the upgrade performed by Apple-authorized repair facilities. Centa Systems warrants its work for 90 days. A RAM disk program that makes up to 316K of RAM available as a memory-resident disk drive is included with this upgrade.

Mass Tech 512K Upgrade

$379.00

Mass Tech Development Labs, Inc.

RATINGS		FEATURES	
B	Overall rating	Additional software:	–
B	Price/performance	90 day warranty:	+
B	Software compatability	Does not void warranty:	–

RATINGS	FEATURES	
C Ease of installation	RAM disk software included:	+
C Documentation		
B Vendor support		

PRODUCT SUMMARY

The Mass Tech RAM upgrade for the Macintosh is similar to upgrades offered by other independent developers. Arrangements must be made to get your Macintosh to Mass Tech to allow the staff to make the upgrade. This upgrade is provided with a 90-day warranty and includes free RAM disk software. This firm also offers an upgrade to 1 megabyte for $995. Before purchasing the 1-megabyte upgrade, call the firm to ensure that it is an upgrade that makes all memory contiguous.

Micro Conversions 512K Upgrade

$365.00
Kit—$265.00

Micro Conversions

Contiguous 1 meg (from 128K)—$995.00
Contiguous 1 meg (from 512K)—$630.00

RATINGS	FEATURES	
B Overall rating	Additional software:	–
B Price/performance	90-day warranty:	+
B Software compatibility	Does not void warranty:	–
C Ease of installation	RAM disk software included:	–
B Documentation		
B Vendor support		

PRODUCT SUMMARY

Micro Conversions offers a variety of memory upgrades for the Macintosh ranging from a kit which allows the user to perform his own upgrade to a board swap that upgrades a Macintosh from 512K to 1 megabyte. The kit is only warranted for the parts since Micro Conversions is not performing the work. All board swap upgrades are warranted for 90 days. The Apple warranty is void if this upgrade is purchased. The 1-megabyte upgrade offers you contiguous memory. It is recognized by the Macintosh finder. The work performed by Micro Conversions is electrically identical to the work performed by an Apple-authorized facility.

WORKSHEET FOR MEMORY UPGRADES

Product

$.

Manufacturer

RATINGS

Overall rating
Price/performance
Software compatibility
Ease of installation
Documentation
Vendor support

FEATURES

Additional software included:
90-day warranty:
Does not void warranty:
RAM disk software included:

PRODUCT SUMMARY

Table 13-1. Comparative Ratings for Memory Upgrades.

Upgrade		Price	Ratings					
			1	2	3	4	5	6
Apple	512K —	$ 700.00	B	B	A	C	D	A
Centa	512K —	350.00	B	B	B	C	C	B
Mass Tech	512K —	379.00	B	B	B	C	C	B
Micro Conversions	512K —	365.00	B	B	B	C	B	B
Kit	512K —	265.00	B	B	B	C	B	B
	128K to 1 meg —	995.00	B	B	B	C	B	B
	512K to 1 meg —	630.00	B	B	B	C	B	B

Key to Ratings

1 - Overall rating
2 - Price/performance
3 - Software compatibility
4 - Ease of installation
5 - Documentation
6 - Vendor support

Table 13-2. Comparative Features for Memory Upgrades.

Upgrade	Features			
	1	2	3	4
Apple 512K	+	+	+	–
Centa 512K	–	+	–	+
Mass Tech 512K	–	+	–	+
Micro Conversion 512K	–	+	–	–
Micro Conversion Kit 512K	–	–	–	–
Micro Conversion 128K to 1 meg	–	+	–	–
Micro Conversion 512K to 1 meg	–	+	–	–

Key to Features

1 - Additional software included
2 - 90-day warranty
3 - Does not void original warranty
4 - RAM disk software included

Chapter 14

Pointing Devices

Pointing devices are used to select items displayed on a screen or to move the cursor around on a screen. They come in a variety of forms, from the built-in arrow keys on the Macintosh numeric keypad through joysticks and graphics tablets to mice.

JOYSTICKS

Joysticks look very much like the flight controllers of small aircraft. The up/down movement of the joystick is read by the Macintosh as up and down movement on the computer screen and left/right movement of the joystick is read as left and right movement on the screen. Joysticks may be used to play games, to control the pointer on the screen in such applications as MacPaint, and to control the pointer in other applications such as Microsoft Multiplan and similar spreadsheet applications. Some joysticks have a push button on the top of the device's vertical shaft. Other joysticks have a second and even a third push button on the base of the joystick.

Trackballs are a form of joystick or even an upside down mouse which uses a rolling ball as opposed to a stick to make the movement. Like joysticks, trackballs have buttons to signify to the computer that an action is required or a response has been provided.

LIGHT PENS

Using a light pen with your computer is like using a pen and pad. Pass the light pen across the screen and a line appears on the screen. Draw circles, boxes, and other shapes by simply pointing the light pen at the screen. You can even make

detailed drawings, using a light pen like a paintbrush. Light pens do not just have a useful purpose in graphics applications, however. You can make a selection from a screen menu by touching the light pen to your choice. You can manipulate text or other data on the screen with a light pen. Educational software that makes use of a light pen can be especially appealing to children. Many children can learn to use a light pen before they are able to use the keyboard, and some types of games are well adapted to light pen technology. The possible practical uses for a light pen are endless.

Light pens are light-sensing devices that look very similar to an ordinary pen. One end has a cord that plugs into an interface port on the computer. The other end generally has a small glass lens.

Light pen functions are based on the principles that govern how a monitor works. The surface of the screen is actually the end of a cathode ray tube (CRT). Inside the tube, a beam of electrons are aimed at the screen's phosphor-coated inner surface. A point, or *pixel*, on the screen is illuminated when the beam strikes it. As the beam moves across the screen from left to right and top to bottom, the points light up momentarily to create an image. The point continues to glow for a moment after the beam has passed. Since the beam cannot strike more than one point at a time, only one point at a time is illuminated. The beam moves so quickly, however (the screen is scanned approximately 60 times each second), that all the points on the image appear to glow together.

A light pen responds to light entering its tiny lens. If you point the light pen at the screen it can sense an illuminated pixel. It then communicates the horizontal and vertical locations of the pixel to the computer. The program interfacing with the light pen uses this information to perform a function such as drawing a line or implementing a menu selection.

There are two types of light pen mechanisms: the push tip style and the touch ring style. The *push tip* version has a depressible, hollow tip protruding about 1/4 inch out of the end of the pen—it looks like a thick ball point pen tip. This tip is placed on the screen surface for positioning. To activate the pen, simply press the tip against the screen. The push tip pen always requires contact with the screen surface to work. The *touch ring* style does not need to touch the screen at all. This type of pen has a metal ring around it, located about 1 inch from the tip. A metal prong is positioned over and slightly above the ring—think of a ball point pen with a sprung clip. This pen is aimed at a point on the screen, is put close to the surface, and is activated by pressing the metal clip against the ring.

The accuracy of a light pen is determined by a number of factors. The type and brightness of a monitor may affect how well a light pen works. You may be able to achieve results using a good-quality monitor that you cannot with a television or poor-quality monitor. An overly sensitive light pen may respond to light from neighboring pixels, especially if you are working in high-resolution mode. Also, errors may occur if the monitor exhibits some interference or noise. If the image jiggles a little, the light pen may be accidentally triggered. Another factor affecting light pen accuracy is the phosphor persistence of the CRT. A pixel's glow begins to decay as soon as the electron beam is no longer striking it. If the pixel continues to glow, indicating a long persistence, the light pen may have difficulty registering accurately. Finally, the human element may cause problems when using a light pen.

Practice may be needed to learn to accurately aim the light pen at the screen to achieve the desired results.

The type of application with which you wish to use the light pen should be considered when you are looking at the quality of the pen. A high-resolution graphics application requires a light pen of high quality as well as a good monitor. For menu selection, text manipulation, or games, the accuracy and resolution capabilities of the pen are not as critical.

There are no light pens currently available for use with the Macintosh. It is very likely that such devices will eventually be used with the Macintosh, however, probably as soon as a number of computer-aided drawing programs are released for the Macintosh. These programs are best used with a graphics tablet or a light pen.

MOUSE DEVICES

A *mouse* is a small, palm-sized "box on wheels" that moves across a flat surface and controls the movement of the cursor. A mouse is supplied with the Macintosh and is used with the keyboard as a primary input device for the Macintosh. The mouse supplied with the Macintosh is placed on the desktop to the right or left of the computer and moved around as desired. A button on the top of the mouse is used to select functions and to highlight selected areas of the screen by pressing the mouse button once or twice. You can also drag an object from one part of the screen to another with the mouse button held down. Experienced Macintosh users have acquired considerable skill with the mouse and often must unlearn it to make use of joysticks, trackballs, graphics tablets, and other input devices. Cursor movement and other functions can be performed considerably faster with the mouse than with the traditional cursor movement keys.

The first mouse was developed in the early 1960s by Douglas Englebart while he was working at Stanford Research Institute on a project to find interactive computer aids. It was described as a small mouselike object with buttons "sticking up on top like ears." The wheels mounted underneath measured movement along the X- and Y-axes which was then converted into the movement of the cursor on the screen. Englebart and his associates used the mouse successfully at the Institute for a number of years.

The mouse was largely ignored for many years, being considered a gimmick by many people. Only lately have people realized that the mouse can significantly enhance the speed and accuracy of many tasks that involve a computer. In several comparison tests, the mouse scored high in word processing use against the light pen, joystick, conventional keypad, and digitizing tablets. They also were less fatiguing to use than the new "touchscreen," because the user's arm did not have to be held up high.

There are two main types of "mice": mechanical and optical. The *mechanical mouse*, which is the older of the two technologies, works by counting the revolutions of a shaft attached to the wheels or ball in the base of the mouse. This may be done electrically or with an optical decoder. The mechanical version has numerous precision-moving parts and is susceptible to breakdown from dust and grit contamination on the desktop. The precision parts also tend to make the mechanical mouse expensive, very delicate, and more difficult to manufacture. The mouse that accom-

panies the Macintosh is a mechanical mouse.

The *optical mouse* has no moving parts and is, therefore, easier and less expensive to make. It tracks its position optically, by passing over an optical grid and counting the lines. The scale of movement can be changed simply by changing the size of the grid. The resolution of the optical mouse is not as fine as the mechanical mouse, but is sufficient for most applications. One drawback is that the optical grid must be kept on your desk when the mouse is in use, increasing the "footprint" of the computer.

Unlike a digitizing tablet, which uses absolute positioning, the mouse uses relative positioning. In *absolute positioning*, there is a one-to-one correspondence between points on the surface of the tablet and points on the screen. *Relative positioning*, however, is based on the total amount of movement of the positioning device, without reference to where it started or where it stops. For example, if you are trying to move the cursor across the screen and run into the side of the keyboard before you can reach your destination, simply pick the mouse up, reposition it to allow sufficient room, and continue moving the mouse. The cursor will start moving from the point where you left off in the same direction as the movement of the mouse.

GRAPHICS TABLETS

Graphics tablets are devices that use a sensitive surface and a pen similar to a light pen to convert physical location and physical motion to the location and movement of a pointer on the computer's screen. These devices are useful with drawing programs of various types, such as MacPaint, MacDraw, and MacDraft. They may also be used with spreadsheet programs. The pen or stylus used with graphics tablets has a sensitive tip and a button to control pen up vs pen down position. When the pen is registered as down, drawing occurs. When the pen is up, movement and location are not recorded.

Apple Mouse

$99.00

Apple Computer, Inc.

RATINGS		FEATURES	
A	Overall rating	Type:	Mechanical mouse
A	Price/performance	Interface:	Mouse port
A	Software compatibility	Cable length:	4′
A	Ease of installation	Buttons:	1
B	Vendor support		

PRODUCT SUMMARY

The Apple Mouse that is supplied with the Macintosh uses the same technology as the mouse for the Apple II family and the Lisa. The Apple II, II+, and *IIe* versions come with an interface card which is installed in a slot on the Apple motherboard. The Apple mouse is installed by plugging it into the mouse port on the back panel of the Macintosh.

The mouse's position is returned in X and Y coordinates with values between 0 and 65535, although the normal setting is to return values between 0 and 1023. The smallest mouse movement that is noticed is 0.02 inch. The values returned also show whether the mouse's button was pressed at this time or at the previous time.

The mouse's state can be read either from assembly language, from the routines built into the Macintosh's user interface toolbox in RAM, or from a programming language using mouse commands. Very few Macintosh applications do not use the mouse.

The price quoted is the replacement price for the mouse that is supplied with the Macintosh.

A+ Mouse

$99.00

Mouse Systems

RATINGS

A	Overall rating
A	Price/performance
A	Software compatibility
A	Ease of installation
B	Vendor support

FEATURES

Type:	Optical mouse
Interface:	Mouse port
Cord length:	4′
Buttons:	1

PRODUCT SUMMARY

The A+ Mouse is an optical rather than a mechanical mouse. It requires a grid to recognize its location and to register motion for the computer. A red scanning light shows through one of two slots in the bottom surface of the mouse. The light is reflected back off the grid to supply the position of the mouse.

The A+ Mouse may installed by plugging it into the mouse port on the back panel of the Macintosh. It is locked into the port by tightening two screws with a screwdriver. This mouse has one button like the Apple mouse. It is used in the same fashion as the Apple mouse.

The optical mouse has no moving parts. It operates very smoothly on the grid. In most ways, its feel is somewhat smoother than the mechanical mouse. Its response to lateral movement may be adjusted by changing the proper Macintosh control panel setting. Because the A+ Mouse has no moving parts, it is easier to maintain than the Apple mechanical mouse, which requires cleaning occasionally. The parts of a mechanical mouse, such as the ball itself and the rollers that hold the ball away from the motion detectors, are subject to wear and may occasionally require replacement. The grid surface of the optical mouse is likewise subject to wear after a period of time.

KAT

$229.00

Koala Technologies Corporation

RATINGS		FEATURES	
A	Overall rating	Type:	Touch tablet
A	Price/performance	Interface:	Mouse port
A	Software compatibility	Drawing area:	4" × 4"
A	Ease of installation	Pickup stylus:	N
A	Vendor support		

PRODUCT SUMMARY

Since KAT is a touch tablet, it operates in a slightly different fashion from graphics tablets such as MacTablet and Macintizer. This device responds to pressure on its surface. Its stylus is not attached to the pad itself as is done with MacTablet and Macintizer. The KAT's active drawing area measures 4 × 4 inches. Its overall size is 9 1/4 × 5 1/2 × 3/4 inches. It is particularly useful for freehand drawing and sketching. KAT connects to the Macintosh's mouse port. It is an extremely compact device, but it does not provide the same degree of control and detail as the MacTablet and the Macintizer.

Macintizer

$599.00

GTCO Corporation

RATINGS		FEATURES	
B	Overall rating	Type:	Graphics tablet
B	Price/performance	Interface:	Mouse port
A	Software compatibility	Drawing area:	9" × 14"
A	Ease of installation	Pickup stylus:	Y
B	Vendor support		

PRODUCT SUMMARY

The Macintizer is a graphics tablet that works in the same fashion as the MacTablet. This graphics tablet uses a stylus to indicate the pointer location and button status to the computer. THe active surface area of the tablet used to represent the desktop is 9 × 14 inches. It is oriented vertically instead of horizontally as is done with the MacTablet. The overall size of this device is 18 × 15 1/2 inches. Neither this graphics tablet nor the MacTablet uses the application of pressure on the tablet's surface in any fashion to detect the mouse location. In some situations, the stylus supplied with the tablet may be replaced with a ball point pen or with a device called a *crosshair cursor* that mounts on the pad. The latter device is recommended for detailed, precision drawing work such as floor plans and landscapes. Since this device uses the mouse port instead of a serial port, it is compatible with a greater number of applications than the MacTablet.

Mac Turbo Touch

$129.00

Assimilation Process

RATINGS		FEATURES	
A	Overall rating	Type:	Trackball
A	Price/performance	Interface:	Mouse port
A	Software compatibility	Cord length:	3′
A	Ease of installation	Buttons:	2
A	Vendor support		

PRODUCT SUMMARY

The Mac Turbo Touch is a trackball for the Macintosh. It plugs directly into the Macintosh's mouse port on the back panel of the computer. It uses a ball mounted on the upper surface of the device to register the direction and location of the mouse pointer on the screen. The Mac Turbo Touch has two buttons, mounted on each side of the ball. Its case is color-coordinated with the Macintosh's case. It requires a smaller footprint than a mouse as it is not moved over the surface of the desktop. Once you have learned to use the mouse, it takes a short time to learn to control the pointer with the trackball. Once this skill is acquired, many users prefer this device to the mouse. This device can be used with spreadsheets, games, drawing programs, scheduling programs, and many other applications.

MacTablet

$495.00

Summagraphics

RATINGS		FEATURES	
A	Overall rating	Type:	High-resolution graphics tablet
B	Price/performance	Interface:	Serial port
A	Software compatibility	Drawing area:	6″×9″
A	Ease of installation	Pickup stylus:	Y
A	Vendor support		

PRODUCT SUMMARY

The MacTablet is a high-resolution graphics tablet that is installed by first plugging the stylus into the tablet. Then the tablet is connected to the Macintosh via either the modem port or the printer port. Power is connected to the tablet by plugging the tablet end of the power converter into the graphics tablet and the power plug into a wall socket. After these connections have been made, the computer may be turned on.

A MacTablet program disk is provided by the manufacturer. A program called MacTablet program disk is provided by the manufacturer. A program called Mac-

Tablet Install on this disk is used to install the MacTablet as a desk accessory which may be selected by the user from the Apple menu. This installation is accomplished by copying MacTablet Install onto a disk that contains a Macintosh System folder. The program is then run, causing the new desk accessory to be installed. After installation of the desk accessory, MacPaint, MacDraw, or whatever application you wish to run with MacTablet should also be copied onto the MacTablet System disk.

MacTablet is 1 inch high, 9 1/2 inches deep, and 12 7/8 inches wide. The active surface used by the stylus is 6 × 9 inches. MacTablet is made of high-impact plastic. It is very light and fits comfortably inside most Macintosh carrying cases. It operates well with MacPaint and MacDraw. Like a trackball and a joystick, you must unlearn mouse skills to acquire stylus skills. Once learned, the use of the stylus with MacTablet becomes quite comfortable.

Mouse Stick

$79.00

Video 7

RATINGS		FEATURES	
A	Overall rating	Type:	Joystick
A	Price/performance	Interface:	Mouse port
A	Software compatibility	Cord length:	4′
A	Ease of installation	Buttons:	1
B	Vendor support		

PRODUCT SUMMARY

The Mouse Stick is a one-button joystick that can be used with the Macintosh by first plugging a joystick adapter into the Macintosh's mouse port and then plugging a joystick into the adapter. The adapter allows the mouse to be plugged in at the same time as the joystick since there is a mouse port in the adapter. You can alternate between the joystick and the mouse without throwing any switches. The joystick's speed of response can be adjusted by using a switch on the back of the adapter. In most instances, the screen pointer cannot be controlled unless the speed is reduced by adjusting this switch.

The Mouse Stick can be used on any application that uses the mouse. It is quite effective with MacPaint when the speed of response has been reduced somewhat. It is also an effective pointing device with applications such as Multiplan. Of course, the most popular use of the joystick is with such games as Airborne, Mac Challenge, and Lode Runner. The mouse is still a little awkward for arcade-type games, and the joystick allows the type of response we all remember from the video arcades.

View Control System

$200.00

Personics Corporation

RATINGS		FEATURES	
B	Overall rating	Type:	Sight controller
A	Price/performance	Interface:	Mouse port
A	Software compatibility	Cord length:	4′
B	Ease of installation	Buttons:	2
B	Vendor support		

PRODUCT SUMMARY

The View Control System is a new concept in cursor control for the Macintosh. It consists of a headset that generates an infrared signal, a box that is placed on top of the Macintosh to receive the headset's signal, two buttons that are mounted on the Macintosh's keyboard, and connectors for the Macintosh. The headset is a lightweight device. It generates an infrared signal that tells the circuits mounted in the small box where the user is looking on the Macintosh's screen. The device and the cursor are controlled by depressing one of the two buttons mounted on the Macintosh's keyboard while the user looks at the screen. The small box is connected to the Macintosh's mouse port. It translates the signal received from the headset into a signal that the Macintosh can recognize.

The manufacturer will be offering an upgrade to this device that allows the user to control the pointer through voice signals. This particular device deserves some consideration for the handicapped and anyone who is oriented more toward visual control than to manual control.

WORKSHEET FOR POINTING DEVICES

Product

$.

Manufacturer

RATINGS	FEATURES
Overall rating	Type:
Price/performance	Interface:
Software compatibility	Cord length:
Ease of installation	Buttons:
Supplied software	Drawing area:
Vendor support	Pickup stylus:

PRODUCT SUMMARY

Table 14-1. Comparative Ratings for Pointing Devices.

Device	Price	Ratings				
		1	2	3	4	5
JOYSTICKS						
Mouse Stick	$79.00	A	A	A	A	B
MOUSE						
Apple Mouse II	99.00	A	A	A	A	A
A+ Mouse	99.00	A	A	A	A	B
GRAPHICS TABLETS						
KAT	229.00	A	A	A	A	A
Macintizer	599.00	B	B	A	A	B
MacTablet	495.00	A	B	A	A	A
TRACK BALLS						
Mac Turbo Touch	129.00	A	A	A	A	A
SIGHT CONTROLLER						
Video Control System	200.00	B	A	A	B	B

Key to Ratings

1 - Overall rating
2 - Price/performance
3 - Software compatibility
4 - Ease of installation
5 - Vendor support

Chapter 15

Specialized Peripherals

In the preceding chapters we have covered the "meat and potatoes" of Macintosh expansion. Interfaces, printers, disk drives, monitors, and modems are the major expensive items that nearly all Macintosh owners will consider adding to their systems. Beyond these major expansion devices lies a whole world of highly specialized peripherals. They are so diverse in their nature and uses that we will describe them briefly in the sections that follow, and then list all of the reviews in alphabetical order. In this way you can consider what types of products you might like to add to your Macintosh within the budget you have allocated for specialized expansion products. The table at the end of the chapter will summarize the ratings for all of the products for quick comparison.

PLOTTERS

With appropriate software, plotters provide high-quality and frequently, multicolored graphs in the form of drawings, bar charts, pie charts, schematics, etc. Because many of the dot-matrix printers now available include the ability to do good-quality graphics presentation, the use of plotters has declined except for very special applications.

POWER AIDS

The consistency of commercial power supplied by the utility companies is inadequate and often unsafe for the normal requirements of today's memory-based electronic equipment. Lightning strikes, start-up of power equipment in the

neighborhood, and the operations of air conditioners or refrigerators can cause sudden voltage increases. They can actually damage and deteriorate the microprocessor, and even alter or erase stored data. *Line noise*, which is the interference caused by the operation of small electrical appliances, can also have harmful effects upon the data.

Two major studies of power disturbances—one in 1974 by IBM and another in 1981 by Bell Laboratories—divided these disturbances into the following categories:

Noise to 200V peak	83+%
Noise greater than 200V peak	1+%
Sags greater than 20%	13%
Surges greater than +10%	1%
Blackouts	2+%

These studies indicated that some type of power fluctuation sufficient to shut down the computer occurs approximately 62 times a year—a little over once a week. To some computer users these protection devices are not considered a luxury item when you consider loss of valuable data and the cost to repair the damage done to the system. They are considered a necessity.

Various products on the market provide protection against some or all of these conditions. The units plug directly into the wall outlet, and then the power plug of the computer is plugged into the unit.

Transient *surge suppressors* are an inexpensive way to suppress noise or voltage surges when they exceed a preset level (usually 200 to 300 volts for a 120-volt line). High-frequency noise suppression depends on the response time of each particular model.

Super isolation transformers are specifically designed to eliminate common-mode noise, which is the most prevalent power line problem. They provide no protection against surges or sags in power.

Voltage regulators are nonisolated devices which make a correction for power sags and surges, but do not remove the line noise.

Ac line conditioners weaken both common-mode and transverse-mode noise, while regulating the voltage. While some ac line conditions claim to be true, they do not actually filter out the noise.

Standby systems (sometimes called off-line UPS) switch in only when the power fails, or when the line voltage goes very low. They will protect you against blackouts and consist of an inverter, a battery, a battery charger, a power monitor and a high-speed transfer switch. Off-line systems cost much less to produce since they do not require the high-powered battery charger. Because it is off-line, it does not use continual power like the on-line UPS. The main factor to consider is its switching or transfer time. The new technology on high-speed transfer switches cuts the transfer time down to 4 milliseconds. Other important features to consider are output waveshape which will affect the computer's performance. Look for the best quality of either sine wave or square wave output. Many units are square wave outputs, which most equipment cannot tolerate for too long. Backup time is also important and will vary with different units. Studies show power outages and fluctuations will

last from 6 seconds or less (about 50 percent) to 10 minutes (about 90 percent). You are mainly looking for enough time to finish current work and shut down the computer. Battery recovery time should also be considered. Most batteries can be brought to 85 percent of full capacity within 2 to 3 hours. Cost is always a factor and a good guideline is a unit costing 10 percent of the cost of the system to be protected.

UPS, or uninterrupted power systems, are on-line, and provide protection against power failures. They also act as ac line conditioners. They can be quite expensive. A typical on-line unit consists of a rectifier/battery charger, an inverter, a battery, a power monitor, and a bypass transfer switch. Since it is always on, it is continually using power, adding to its cost, and while it is on it heats up, creating the need for a cooling system—another cost.

SECURITY

It is hard to believe that theft, manipulation, and vandalism of computer data amounts to some $3 billion a year. Information is sold to competitors, totally destroyed, altered, and in some cases ransomed back to the original owner. There are currently no federal statutes covering this area and the few state statutes are confusing or totally ineffective. Crimes include credit card scams; illegal bank fund transfers; payroll record tampering; and theft of product designs, research data, marketing plans, customer lists, and privileged client information.

Some systems using a common password or those featuring call-back protection can be tampered with through transmission lines or through the gain of access to the codes. Other systems are based on the Federal Data Encryption Standard, a very sophisticated approach for protecting both stored and transmitted data. The National Bureau of Standards recommends four methods which are software-selectable: Electronic Code Book, Cipher Feedback, Cipher Block Chaining, and Output Feedback. For more detailed information ask for the Federal Information Publication #46.

Datasaver

200 watt—$495.00

Cuesta Systems, Inc.

RATINGS

A Overall rating
A Price/performance
A Ease of installation
A Documentation
A Vendor support

FEATURES

Type: Standby power system

PRODUCT SUMMARY

The Datasaver prevents the accidental loss of data, which may be caused by an interruption in the normal power supply, by automatically switching to its inter-

nal power within 1/100 second. It can also be used as a portable power supply by plugging an external 12-volt battery into the appropriate jacks in the rear. The internal, rechargeable battery on this unit provides from 5 to 15 minutes of operating time, depending on whether you are operating at full- or half-rated output power.

There are audible and visual alarms as well as an interrupt signal to indicate when the normal power supply has been interrupted and the Datasaver has taken over. The unit is small and fits easily on the desktop. There is no installation since the Datasaver plugs into an ac power receptacle and the computer is plugged into it.

The Datasaver meets all UL, FCC, and CSA standards and has a 1-year limited warranty.

DataShield Backup Power

PC-200—$359.00
XT-300—$499.00

PTI Industries

RATINGS

B Overall rating
B Price/performance
A Ease of installation
A Documentation
B Vendor support

FEATURES

Type: Standby power system

PRODUCT SUMMARY

The DataShield Backup Power Sources are battery-operated auxiliary generators. They also contain a built-in surge protector. These features protect you against a total blackoutand power surges above 140 volts. They filter out the line noise from appliances. When the power falls below 108 volts, the system switches over to the battery. On the PC-200 this occurs within 10 milliseconds and on the XT-300 it occurs within 4 milliseconds. When you are operating at full load, you have 5 minutes of backup power. You have 20 minutes of backup power when you are operating at half load.

The surge protection operates continuously to guard against any harmful surges. A flashing light indicates that the battery is running low and needs recharging. The battery is a long-life one (4 years) and requires 10 to 12 hours to recharge.

The XT-300 (at 300 watts output) is designed for hard disk drives. Both of these models are FCC-approved for safety, and there is a 6-month warranty on parts and labor.

DataShield Model 100

$89.95

PTI Industries

RATINGS

B Overall rating

FEATURES

Type: Surge protector

RATINGS

B Price/performance
A Ease of installation
B Documentation
C Vendor support

PRODUCT SUMMARY

The DataShield Model 100 surge protector will eliminate voltage surges and will filter noise that can damage the computer or the peripherals. It has six outlets, so you can plug in the computer and up to five other devices. Two of the six sockets are devoted to superfiltration for extrasensitive equipment. The wall power enters the DataShield and passes through circuitry which filters the voltage before it reaches the computer's receptacles. A light signal and a buzzer alert you to a *brownout*, when voltage drops to levels below 100 volts, and has a reset button to guard against excessive voltage surges upon return of power. An unlit LED indicates this reset button must be pressed. Response time for surge protection is 0.1 nanoseconds. Noise is attenuated from −20 dB to −100 dB, and noise protection ranges from 100 kHz to 300 MHz.

The unit is warranted for 6 months and can handle large power demands from a monitor, printer, etc.

DMP-29 Plotter

$2295.00

Houston Instrument

RATINGS

A Overall rating
B Price/performance
A Ease of installation
B Documentation
A Vendor support

FEATURES

Type: Plotter

PRODUCT SUMMARY

The DMP-29 is an 8-pen plotter which produces either 8 1/2-×-11-inch or 11-×-17-inch copies on either heavy bond, vellum, or film paper. This unit is compatible with most graphics software, allowing you to create graphs, charts, technical drawings, medical drawings, architectural drawings, and maps.

With the DM/PL, Houston Instrument's plotter language, you can create eight sets of characters (including European), at any of 360 possible angles and in 255 sizes. The DMP-29 will not only draw solid lines or any combination of dots and dashes automatically, but it will plot just a section of the entire presentation or scale too-large or too-small plots down or up to size. The DMP-29 performs quickly, at 22 inches per second, and quietly, at less than 60 dBm.

The firmware includes all commands supported by the DM/PL. Character sets

include slant (italics); there are 93 uppercase and lowercase characters, and the character width is selectable independent of the height and defaults to 86 percent of the height. The front panel includes touch-sensitive buttons for power on/off, home, load, X- and Y-axis deadzone test pattern, large and small X pattern for dynamic balancing, stairstep pattern for linearity testing and self-test and ROM/RAM diagnostics. Arrow buttons control pen movement.

Connection to your computer is by RS-232C serial, Centronics-type parallel, or GPIB interface. In the case of the Macintosh, the serial interface is preferred. A special driver program, such as available on a disk called Plot-It sold by Mesa Graphics, is required to use this plotter. The driver must be installed in the System folder on the disk containing any Macintosh application being used.

DMP-40 Plotter

$995.00

Houston Instrument

RATINGS

A Overall rating
A Price/performance
A Ease of installation
B Documentation
A Vendor support

FEATURES

Type: Plotter

PRODUCT SUMMARY

This is a single-pen plotter which allows you to create graphics on 8 1/2-x-11-inch or 11-x-17-inch bond, vellum, or mylar paper. By using the Pause command provided with most software, you are able to change the pen to another color. Circles, ellipses, arcs, and curves are easily drawn and tracing is done by plotting in increments of only 0.005 inch.

The standard plotter hard nib pen is used, or you can use a ball point or film ink pen. Black, red, blue, and green colors are included.

The front panel includes touch-sensitive buttons for controlling small or large paper size, local movement of the pen with four arrow buttons, scaling, baud rate, addressability, self text, and clipping or windowing. The Draw commands include vector generation, absolute or relative, arc generation, circle generation, ellipse generation, and curve fit generation. The Text commands include Print mode, 93 uppercase and lowercase characters, variable height, rotation and aspect ratio, italics, and special centered markers. Control commands include English or metric, report back, query plotter identification, windowing, viewport with scaling, internal self-tests, handshaking, and velocity.

The DMP-40 weighs about 10 1/2 pounds, and is 4.4 inches high x 21.2 inches wide x 8.0 inches deep. The standard RS-232C interface allows you to connect this plotter to your computer. A special driver program such as those that are available on a disk called Plot-It sold by Mesa Graphics, is required to use this plotter. The

driver must be installed in the System folder on the disk containing any Macintosh application being used.

Lemon/Lime/Peach/Orange

$59.95—Lemon
$89.50—Lime
$97.50—Peach
$139.95—Orange

EPD, Inc.

RATINGS

A Overall rating
B Price/performance
A Ease of installation
B Documentation
B Vendor support

FEATURES

Type: Surge protectors

PRODUCT SUMMARY

The Lemon, Lime, Peach, and Orange are good-quality surge protectors from EPD, Inc. They represent a small expense to protect your increasingly valuable complex of computer peripherals, all of which are subject to damage by power surges. Line filtering also helps prevent interference between any pair of devices. Many "mysterious" hardware problems go away when a filtering surge protector is used with the system.

The Lemon attaches directly into the wall socket and has six plug receptacles. The Lime sits on the floor, has a power cord to plug into the wall socket, and has six plug receptacles. The Peach and the Orange surge protectors feature line filtering. The Peach attaches directly to the wall and has three receptacles. The Orange is a floor model and has six receptacles. The Orange has a response time of 5.0 nanoseconds to power surges. It attenuates noise from – 5 dBs to – 58 dBs and protects against noise at frequencies ranging from 150 kHz to 30 MHz.

The MAX SS/2

$79.00

Panamax

RATINGS

B Overall rating
B Price/performance
A Ease of installation
B Documentation
B Vendor support

FEATURES

Type: Surge Protector

PRODUCT SUMMARY

Panamax has a whole line of good-quality surge protectors. The MAX SS/2 has two plug receptacles, plugs directly into the wall socket, and protects against power surges and noise interference. Some of the other surge protectors from Panamax include: UltraMAX with four plug receptacles, a power cord to plug into the socket, on/off switch, brownout protection, circuit breaker, and undervoltage alarm ($159.00); SS/6 LCS with six plug receptacles, on/off switch, circuit breaker and a power cord to plug into the socket ($119.00); TeleMAX with one plug receptacle and two phone jack hook-ups ($89.00). All of the units come with a 5-year warranty.

Micro-UPS, Model 3056

$1995.00

RTE DELTEC Corporation

RATINGS

C Overall rating
C Price/performance
C Ease of installation
A Documentation
A Vendor support

FEATURES

Type: Uninterruptible power system

PRODUCT SUMMARY

This on-line UPS provides continual voltage regulation and noise elimination to personal computers. It also provides a battery reserve for complete power outages. The internal 10-minute battery included in the purchase price can also be used with external 48-volt batteries for extended periods. Unlike other power supplies, there is no switching when the power changes or fails completely because the battery is already on-line. In the event of internal failure, a bypass switch transfers the load to the input or utility line. The 10-minute internal reserve time may be lengthened to 1 hour with the optional battery pack.

RTE DELTEC offers a 1-year warranty on materials and workmanship.

Minicomputer Regulators

60 Hz—$169.40 and up
50 Hz—$228.60 and up
Hard-wired—$202.57 and up

Scla Electric

RATINGS

B Overall rating
B Price/performance
A Ease of installation
B Documentation
A Vendor support

FEATURES

Type: Super isolation transformer

PRODUCT SUMMARY

The Minicomputer Regulator series comes in three models, the 60 Hz single-phase (portable) model, the 50 Hz single-phase (portable) model, and the 60 Hz single-phase (hard-wired) model. All models are UL listed.

These regulators are designed to detect and correct both transverse and common-mode noise. They suppress transients and protect the equipment from overloads, brownouts, and other line-voltage fluctuations. The waveshape output is sine wave. The two portable models have an input off/on switch. Common noise is rejected at 120 dB and transverse noise at 60 dB.

The portable models plug into the wall. The hard-wired models are designed to be mounted on the wall. Sola recently came out with a rack-mount version of this unit ($826.85) designed for applications where rack-mounting is more convenient. These units are approximately 9.81 × 19 × 10.46 inches. Rack-mount models feature input/output voltmeters and output current ampmeters, four output circuit breakers to protect the unit from overload, two 15-amp output receptacles, and a heavy-duty cord. The indicator light and power switch are located on the front panel.

Mini UPS

60 Hz—$1665.00

Sola Electric

RATINGS

B Overall rating
C Price/performance
A Ease of installation
B Documentation
A Vendor support

FEATURES

Type: Uninterrupted power supply

PRODUCT SUMMARY

The Mini UPS is a portable on-line unit that continuously supplies power. It uses a long-life, maintenance-free battery that is built into the unit. The Mini UPS also regulates the output voltage and protects the load from noise, line interference, and brownout conditions. The Mini UPS uses a single-phase 120 Vac input and is available in 60 Hz with either a 400 VA output, or a 750 VA model, which is UL approved. There is also a 600 VA, 50 Hz unit ($1950).

The output waveshape is a sine wave. If the Mini UPS is operated at less than full load, the battery backup time will be extended. If it is operated at full load, optional battery packs are available for more backup time.

The Mini UPS features an automatic shut-off circuit that disconnects the battery during prolonged power outages to prevent damage to the battery. When regular power is restored, the battery is automatically recharged to 95 percent of its capacity in less than ten times the discharge time.

The on/off switch on the front panel controls the inverter. The battery will con-

tinue charging when the unit is turned to off. Lights on the front panel indicate that the inverter is on, the charger is on, and the line power is operating.

There are two other models available in this series: the Deluxe model ($2180) featuring automatic inverter restart, which allows the inverter to restart once the normal power is restored following a shutdown from a discharged battery. A battery supplying power to the alarm circuit indicates that the inverter is being powered by the battery when the power fails. The High Inrush Current models ($2415) supply up to six times the rated current for very short durations. They are usually used for applications requiring large inrush currents.

Power Line Monitor

$303.00

Sola Electric

with printer—$964.00

RATINGS

B Overall rating
C Price/performance
A Ease of installation
B Documentation
A Vendor support

FEATURES

Type: Power line monitor

PRODUCT SUMMARY

The Power Line Monitor is used to determine the cause of power problems. Sola Electric makes five models, three of which print out information on the type of disturbance, and the date and time of the occurrence. The printing monitors also check on low-line frequency, while the deluxe printing model ($2390) provides information on temperature and the load's dc power supply.

These units could be of assistance to you in determining typical power problems in your environment before you purchase a power conditioner for your system. An audible alarm sounds when a problem occurs. A chart on the unit provides information on typical power problems, their possible causes, and the type of equipment needed to solve the problem. The typical power problems covered include power failure, low-line voltage, high-line voltage, voltage spike, voltage drop, high-frequency noise, high-line frequency, and low-line frequency.

The two nonprinting models feature six LEDs to indicate which problem is occurring. They do not include information on high- or low-line frequency. There is a button for Clear and another for Test. The unit itself is 3 × 5 × 7 inches and weighs about 2 pounds.

The printing models feature eight LEDs to indicate the cause of the power problem, and three LEDs to indicate the status of the audible alarm, the printer, and the external alarm contacts. Control buttons allow you to clear, test, or lock the unit; advance the paper; advance and set the clock, and turn off the alarm and the printer.

The deluxe printing model (#80-006-60) further features control buttons for print status/clear summary and print thresholds/print summary, and a button to move the

clock backward in time. A row of DIP switches are included for setting the power failure/power restore thresholds, the line frequency tolerance, and the 120/240-volt operation. There are two single switches to set the temperature and the volt line operation. The small temperature probe sits alongside the monitor. These printing models are about 11 × 3 × 3 inches and weigh about 6 1/2 pounds.

All of these models are completely portable and are easily plugged into any wall outlet.

Powermaker Micro UPS

$820.00
Topaz, Inc. -$1195.00

RATINGS

B Overall rating
A Price/performance
A Ease of installation
B Documentation
B Vendor support

FEATURES

Type: Standby power system

PRODUCT SUMMARY

Topaz makes a number of different models in this price range and different models reflect the voltage (120 or 220), the amount of standby power provided, and the length of time the unit will run on its internal battery. Several models feature a signal to the computer to shut down while unattended, called a *status monitor.*

All models feature maintenance-free batteries, which take about 16 hours to recharge. There is overload and short-circuit protection, and the low-battery sensor prevents the batteries from discharging beyond their capacity. There is a beeper to alert you when the power has failed; however there is no way to tell when the battery is low. Noise attenuation begins at 10 kHz; 40 dB minimum at 100 kHz and above.

Typical backup time, depending on model, ranges from 9 minutes (full load) to 30 minutes (half load), 12 minutes to 35 minutes, and 35 minutes to 75 minutes of sine wave output.

Typical transfer time, power line to inverter, is 4 milliseconds (10 ms maximum). From inverter to power line is 2 milliseconds (4 ms maximum).

The 60 Hz (120V) models are UL approved for safety.

SC14 Signal Conditioner

1-channel—$ 44.00
4-channel—$255.00
Interactive Structures, Inc. 16-channel—$440.00

RATINGS

B Overall rating

FEATURES

Type: Ac line conditioner

RATINGS

B Price/performance
B Ease of installation
C Documentation
B Vendor support

PRODUCT SUMMARY

The SC14 series is intended to extend analog input systems. Interactive Structures manufactures two such analog input systems: the AI02 and the AI13. The SC14 is available in 1, 4, or 16 channels.

The channels can be programmed by using the plug-in DIP function modules. Weak or noisy signals are accepted by the SC14 and filtered to improve accuracy of the readings. The signals are output at 0 to 5 volts.

The 1-channel model includes a small circuit card which connects to the input system with a shielded 3-conductor cable. The 4-channel connects to the input system with a 6-foot ribbon cable. The 16-channel model has four 4-channel circuit boards inside a rack-mountable metal case and a 6-foot cable. The inputs and grounds are easily installed.

Spikemaster

$79.95

Discwasher

RATINGS

A Overall rating
A Price/performance
A Ease of installation
B Documentation
A Vendor support

FEATURES

Type: Surge protector

PRODUCT SUMMARY

Spikemaster is a high-quality spike protector and line filter. It is built of heavy-duty components and offers a circuit breaker, five-way filtering, and an on/off switch with indicator light. It can handle a total load of 15 amps, more than enough for a large computer system. Spikemaster is the sturdiest spike/surge protector we have seen, and it works well in areas with a notoriously bad power supply.

SPS (Standby Power Source)

$828.00

Sola Electric

RATINGS

B Overall rating

FEATURES

Type: Standby power system

RATINGS

B Price/performance
A Ease of installation
B Documentation
A Vendor support

PRODUCT SUMMARY

Sola's SPS is an off-line power system designed to protect the computer against interference on the ac line as well as against power failures. Transfer time from line to inverter is 4 to 10 milliseconds, when the voltage drops below 15 percent. At half load it offers 30 minutes typical reserve time and at full load it offers 12 minutes. The SPS provides a clean, sine-wave output. Two models offer either 400VA to 800VA ($983) power.

When the line power is on, the SPS offers protection against noise and other interference, and recharges itself automatically. It also offers inverter overcurrent protection and an alarm sounds to alert the user that it is switching to battery power.

The SPS is 15 inches high, 7 inches wide, and 18 1/2 inches deep and the 400 VA unit weighs 65 pounds. Both models operate at 60 Hz and are UL approved for safety. Sola Electric has been in this business for over 50 years and offers technical and installation assistance.

WORKSHEET FOR SPECIALIZED PERIPHERALS

Product

$.

Manufacturer

RATINGS
Overall rating
Price/performance
Ease of installation
Documentation
Vendor support

FEATURES
Type:

PRODUCT SUMMARY

Table 15-1. Comparative Ratings for Specialized Peripherals.

Device	Type	Price	Ratings				
			1	2	3	4	5
Datasaver	SPS	$495.00	A	A	A	A	A
DataShield Model 100	SP	89.95	B	B	A	B	C
DataShield PC-200 and	SPS	359.00	B	B	A	A	B
XT-300	SPS	499.99	B	B	A	A	B
DMP-29	PL	2295.00	A	B	A	B	A
DMP-40	PL	995.00	A	A	A	B	A
Lemon	SP	59.95	A	B	A	B	B
Lime	SP	89.50	A	B	A	B	B
Peach	SP	97.50	A	B	A	B	B
Orange	SP	139.95	A	B	A	B	B
The MAX SS/2	SP	79.00	B	B	A	B	B
Micro-UPS Model 3056	UPS	1995.00	C	C	C	A	A
Minicomputer Regulators							
—60 Hz	SIT	169.40	B	B	A	B	A
—50 Hz	SIT	228.60	B	B	A	B	A
—Hard-wired	SIT	202.57	B	B	A	B	A
Mini UPS	UPS	1665.00	B	C	A	B	A
Power Line Monitor	PLM	303.00	B	C	A	B	A
with printer	PLM	964.00	B	C	A	B	A
Powermaker Micro UPS	SPS	820.00	B	A	A	B	B
SC14 Signal Conditioner							
1-channel	ACLC	44.00	B	B	B	C	B
4-channel	ACLC	255.00	B	B	B	C	B
16-channel	ACLC	440.00	B	B	B	C	B
Spikemaster	SP	79.95	A	A	A	B	A
SPS (Standby Power System)	SPS	828.00	B	B	A	B	A

Key to Ratings

1 = Overall rating
2 = Price/performance
3 = Ease of installation
4 = Documentation
5 = Vendor support

Key of Abbreviations

ACLC = AC Line Conditioner
PL = Plotter
PLM = Power Line Monitor
SIT = Super Isolation Transformer
SS = Security System
SP = Surge Protector
SPS = Standby Power System
UPS = Uninterrupted Power System

Appendix

Appendix A

User's Groups

A *user's group* is a group or club focused on an aspect of computers. Some clubs direct their attention to one particular computer; there are many Macintosh user's groups, some of which are listed here. Other groups focus on a language, an operating system, an area of application, or other aspects of computing. Many magazines on computing carry lists of clubs/groups and report on their activities. Many local newspapers carry announcements of user's group meetings. Computer stores and software stores in your neighborhood may have announcements about these meetings posted on their bulletin boards.

User's groups provide a valuable opportunity to get and give advice on Macintosh hardware, software, and applications. Often you can talk to someone who used a product you are considering buying. User's group newsletters may also offer useful information. If you need a programmer or consultant, you may meet or hear about a good one at a user's group meeting.

The Anchorage Mac User Group
c/o Nevin McClintock
1200 Diamond #812
Anchorage, AK 99515

Apple SAC
P.O. Box 254645
Sacramento, CA 95825

Bay Area MacForum
1515 Sloat Blvd. Ste. 2
San Francisco, CA 94132

Berkeley Macintosh Users Group
1442A Walnut St. Suite #153
Berkeley, CA 94709

Boston Computer Society Macintosh User Group
1 Center Plaza
Boston, MA 02108

Capitol Macintosh Users Group
9431 Georgia Avenue
Silver Spring, MD 20910

Conejo Valley Macintosh Users Group
P.O. Box 7118
Thousand Oaks, CA 91359

Double Click
Macintosh Users Group
6431 No Hyacinth
Glendale, WI 53217

East Bay MUG
5901 Broadway #7
Oakland, CA 94618

El Paso Mac User Group
5534 Ketchikan
El Paso, TX 79924

Eugene Macintosh Users Group
P.O. Box 10988
Eugene, OR 97440

Hawaii Macintosh Users Group
P.O. Box 1355
Pearl City, HI 96782

Los Angeles Macintosh Group
12021 Wilshire Blvd. #349
Los Angeles, CA 90025

Mac Desert Users Group
36953 Hayward Ave.
Barstow, CA 92311

Mac-Hollywood Users Group
P.O. Box 27429
Los Angeles, CA 90027

Mac Mania
964 Nottingham Dr.
Corona, CA 91720

Mac Orange
P.O. Box 2178
Huntington Beach, CA 92647

Mac Users of Rogue Valley
502 NE Dean Dr.
Grants Pass, OR 97526

MACS—Macintosh Apple Club of Spokane
N. 6409 Cincinnati
Spokane, WA 99205

Macintosh Computer Users Group
Sangamon Valley
1540 W. Cook St.
Springfield, IL 62704

Macintosh User Group
ICOR 200 W. Washington
Fairfield, IA 52556

Macintosh Users Group
924 Holbrook
Ft. Walton Beach, FL 32548

MacPoint
5704 Harper #201
Chicago, IL 60637

Mid Cities Macintosh
1209 Glen
Ellis, TX

Montana Mac
1700 Fox Farm Rd.
Great Falls, MT 59404

MUGWUMP
Computer Services—Uris Hall
Cornell University
Ithaca, NY 14853

NAC MAC Users Group
4304 Friar Tuck
Nacogdoches, TX 75961

Oak Ridge Macusers Group
Rte. 2 Box 65E
Oliver Springs, TN 37840

Oklahoma City Macusers
P.O. Box 6915
Lawton, OK 73505

San Diego Macintosh User Group
P.O. Box 12561
La Jolla, CA 92037

SEMCO Mac Pac
P.O. Box 02426
Detroit, MI 48202

Sequoia Macintosh Users' Group
P.O. Box 6423
Arcata, CA 95521

Shenandoah Mac Users Group
1131 So. Winchester Ave.
Waynesboro, VA 22980

ShowPage Macintosh User Group
2040 Polk St.
San Francisco, CA 94109

Southeastern Michigan Mac Users Group
9720 Lakewood
Grosse Ile, MI 48138

Stanford Macintosh User Group
P.O. Box 6508
Stanford, CA 94305

TCS Mac Users Group
C/O The Computer Store
740 North Main St.
Providence, RI 02904

The New York Macusers' Group
P.O. Box 6686 Yorkville Station
New York, NY 10128

Ventura County Macintosh Club
1413 S. Victoria Ave.
Ventura, CA 03003

Victoria Macintosh Users Group
P.O. Box 5338-B
Victoria, BC V8R 6S4
Canada

Washington Apple Pi
Macintosh SIG
8227 Woodmont Ave.
Bethesda, MD 20814

Yale Macintosh Users Group
P.O. Box 220 Yale Station
New Haven, CT 06520

Appendix B

Bulletin Boards

PUBLIC ACCESS MESSAGE (and file transfer) SYSTEMS
(P.A.M.S.)

Compliments of Peoples' Message System, Santee CA.
(6 1 9) 5 6 1 - 7 2 7 7
Compiled and maintained by Bill Blue
(with a lot of help from his friends)

Please send updates/corrections to:
P M S Santee, TCB117, 70315,1305 or BBLUE

*	denotes 24-hour operation
+	denotes 8-12 hour DAYTIME operation ONLY
–	denotes 8-12 hour NIGHTTIME operation ONLY
!	new system or new number to existing system
$	Supports VADIC 1200 baud operation
&	Supports 212A 1200 baud operation
%	Supports BAUDOT operation
#1	denotes original system of that type
dd.	denotes game oriented messages
dl.	download/program exchange system
ml.	mail/information exchange only
rb.	denotes call, let ring once and call back

rl. religious orientation
so. sexually oriented messages

Regular updates of this list may be found on CompuServe MAUG XA4, The Source PUBLIC 112, and most participating independent P M S systems.

ABBS Akron Digital Group, Akron, OH .....(216) 745 7855*
ABBS Analog, Port Coquitlam, BC, CN .....! (604) 941 0041*
ABBS Apple-Mate, New York, NY.....(201) 864 5345
ABBS Byte Shop, Ft. Lauderdale, FL .....(305) 486 2983
ABBS Byte Shop, Miami, FL.....(305) 261 3639
ABBS Calvary Mission Church, Mnpls, MN.....(612) 472 3985*rl.
ABBS CCNJ, Pompton Plains, NJ .....(201) 835 7228
ABBS Charlotte, NC .....(704) 364 5245*
ABBS CODE, Glen Ellyn, IL .....(312) 882 2926*
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ABBS Compumart, Ottawa, Ontario, CN.....(613) 725 2243
ABBS Computer Room, Kalamazoo, MI.....(616) 382 0101
ABBS Gamemaster, Chicago, IL .....(312) 475 4884*
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ABBS LINX, Lincoln, NE.....(402) 476 1177*dl.
ABBS New York, NY.....! (516) 473 1005*
ABBS New York, NY.....! (212) 877 7703*
ABBS Nessy Game System, Itasca, IL.....(312) 773 3308*
ABBS Nessy Flynn's BBS, Crystal Lake, IL.....(815) 455 2406
ABBS Omaha, NE .....(402) 339 7809
ABBS Pacific Palisades, Los Angeles, CA .....(213) 459 6400
ABBS Peoria, IL.....(309) 692 6502
ABBS Phoenix, AZ .....(602) 898 0891
ABBS Pirates Cove, Long Island, NY .....(516) 698 4008
ABBS Rogers Park, Chicago, IL .....(312) 973 2227
ABBS Software Sorcery, Herndon, VA.....&(703) 471 06101
ABBS South of Market, San Francisco, CA .....(415) 469 8111 so.
ABBS The Pulse, Dallas, TX.....(214) 631 7747*so.
ABBS Teledunjon III, Dallas, TX.....(214) 960 7654
ABBS Turnersville, NJ .....(609) 228 1149
ABBS Vancouver, BC, CN.....(604) 437 7001
ABBS Vermont, Essex Junction, VT .....(802) 879 4981*
ABBS Video Adv. Movie Marquee, Evanston, IL.....(312) 475 5282
ABBS West Palm Beach, FL .....(305) 848 3802
ACS Arlington Heights, IL.....#1 (312) 392 2403
ACS Chicago, IL.....(312) 445 1130
A-C-C-E-S-S Annapolis, MD .....(301) 267 7666*
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ARMUDIC Washington, DC .....#1 (202) 276 8342
ARMUDIC Computer Age, Baltimore, MD .....(301) 587 2132
BBS IBM Hostcomm Atlanta, GA .....(404) 252 4146
BBS IBM Hostcomm Fairfax, VA .....(703) 978 9592*
BBS IBM Hostcomm Fairfax, VA .....!(703) 385 7373*
BBS IBM Hostcomm Fairfax, VA .....!(703) 385 8384*
BBS IBM Hostcomm Springfield, VA .....(703) 425 7229*
BBS IBM Hostcomm Houston, TX .....(713) 890 0310*
BBS IBM Hostcomm Toronto, Ontario, CN .....(416) 499 7023*
BBS IBM PC Annandale, VA .....(703) 560 0979*
BBS IBM PC Atlanta, GA .....!(404) 928 3005
BBS IBM PC Atlanta, GA .....(404) 252 9438*
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BBS IBM PC Computer Society, Boston, MA .....(617) 353 9312-
BBS IBM PC Culver City, CA .....&(213) 649 1489*
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BBS IBM PC Dale City, VA .....(703) 680 5220*
BBS IBM PC Gaithersburg, MD .....(301) 251 6293*
BBS IBM PC Great Falls, VA .....&(703) 759 5049*
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BBS IBM PCmodem Chicago, IL .....&(312) 882 4227*
BBS IBM PCmodem Chicago, IL .....(312) 376 7598*
BBS IBM PC SIG, San Diego, CA .....!(619) 268 0437*
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BULLET-80 Danbury, CT .....#1(203) 744 4644
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CBBS Cedar Rapids, IA.....(319) 364 0811*
CBBS Chicago, IL.....#1(312) 545 8086*
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CBBS LICA LIMBS, Long Island, NY.....(516) 561 6590*
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CBBS Long Island, NY.....(516) 334 3134*
CBBS MAUDE Milwaukee, WI.....(414) 241 8364*
CBBS MicroStar, Worcester, MA.....(617) 752 7284
CBBS NW, Portland, OR.....(503) 646 5510*
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CBBS Proxima, Berkeley, CA.....(415) 357 1130
CBBS RAMS, Rochester, NY.....(716) 244 9531
CBBS Rosemont, MN.....(612) 423 5016
CBBS St. Petersburg, FL.....(813) 866 9945*
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CBBS TSG, Tucson, AZ.....!(602) 574 0327*
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COMNET-80 Las Vegas, NV.....&(702) 870 9986
COMNET-80 Mt. Clemens, MI.....&(313) 465 9531
COMNET-80 North Wales, PA.....(215) 855 3809 so.
COMNET-80 Riverside, CA.....&(714) 359 3189
COMNET-80 Riverside, CA.....&(714) 877 2253
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CONNECTION-80 Orlando, FL.....(305) 644 8327*
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CONNECTION-80 Winter Garden, FL.....(305) 894 1886*
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CONFERENCE-TREE Computerland, Honolulu, HI.....(808) 487 2001*

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CONFERENCE-TREE Santa Monica, CA ..... (213) 394 1505
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CONFERENCE-TREE Tacoma, WA ..... !(206) 759 0615*
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DIAL-YOUR-MATCH #3 ..... (912) 233 0863 so.
DIAL-YOUR-MATCH #4 ..... (213) 783 2305 so.
DIAL-YOUR-MATCH #8, San Francisco, CA ..... (415) 467 2588 so.
DIAL-YOUR-MATCH #9 ..... (213) 345 1047 so.
DIAL-YOUR-MATCH #11, Carlsbad, CA ..... (619) 434 4600*so.
DIAL-YOUR-MATCH #12, Houston, TX ..... (713) 556 1531*so.
DIAL-YOUR-MATCH #14 ..... (201) 272 3686 so.
DIAL-YOUR-MATCH #16 ..... (206) 256 6624 so.
DIAL-YOUR-MATCH #17 ..... (415) 991 4911 so.
DIAL-YOUR-MATCH #18 ..... (617) 334 6369 so.
DIAL-YOUR-MATCH #20 ..... (919) 362 0676 so.
DIAL-YOUR-MATCH #21, Freehold, NJ ..... (201) 462 0435 so.
DIAL-YOUR-MATCH #22 ..... (213) 990 6830 so.
DIAL-YOUR-MATCH #23, Omaha, NE ..... (402) 571 8942 so.
DIAL-YOUR-MATCH #26, Clovis, CA ..... (209) 298 1328 so.
DIAL-YOUR-MATCH #33, Poway, CA ..... (619) 748 8746*so.
DIAL-YOUR-MATCH #37, Flint, MI ..... (313) 736 1398 so.
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DIAL-YOUR-MATCH #46, ... !(318) 222 2032-so.
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FORUM-80 Wichita, KS.....&(316) 682 2113*
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GABBS Food for Thought, Omaha, NE.....!(402) 551 4618*
GABBS Mindstore, Terre Haute, IN.....!(812) 235 0909*
GABBS The Great Apple, Houston, TX.....(713) 455 9502*
GABBS Vox Populi, Houston, TX.....!(713) 772 6096*
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GREENE MACHINE Riverside, CA.....(714) 354 8004
GREENE MACHINE Chicago, IL.....(312) 622 4442 so.
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GREENE MACHINE Rome, NY.....(315) 337 7720
GREENE MACHINE Sunnymead, CA.....!(714) 924 2229*
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HBBS MOG-UR, Granada Hills, CA.....&(213) 366 1238*
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MCMS P.C.M.S. Wheaton, IL.....&(312) 462 7560*
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MCMS NC Software, Minneapolis, MN.....(612) 533 1957*
MCMS WACO Hot Line, Schaumburg, IL..<pvt>.....(312) 351 4374*
MCMS Word Exchange, Springfield, IL.....(217) $53 4309*
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NET-WORKS Apple Net, Chicago, IL.....(312) 963 5384
NET-WORKS Apple-Technical, Chicago, IL.....(312) 935 3091
NET-WORKS Armadillo, Grand Forks, ND.....(701) 746 4959
NET-WORKS Assembly Line, Louisville, KY.....(502) 459 5531-
NET-WORKS Asylum, Edwardsville, IL.....(618) 692 0742
NET-WORKS Baud-ville, Louisville, KY.....(502) 423 0695-
NET-WORKS Beach BBS, Pensacola, FL.....(904) 932 8271
NET-WORKS Big Apple, Miami, FL.....(305) 948 8000
NET-WORKS Briar-Net, Houston, TX.....(713) 782 5706*
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NET-WORKS Computer Pro, Ft. Worth, TX.....(817) 732 1787

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NET-WORKS Fourth Dimension, St. Louis, MO.....(314) 532 4652
NET-WORKS GBBS Metro Detroit, MI.....(313) 455 4227 so.
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NET-WORKS Honolulu, HI.....!(808) 524 6652
NET-WORKS Hawaii Connection, Honolulu, HI.....(808) 423 1593*
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NET-WORKS Livingston, NJ.....(201) 994 9620*
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NET-WORKS Magnetic Fantasies, Los Angeles, CA.....(213) 388 5198
NET-WORKS MicroBBS, Chelmsford, MA.....!(617) 889 4330
NET-WORKS Micro Ideas, Glenview, IL.....(312) 998 5066
NET-WORKS Mines of Moria, Houston, TX.....(713) 871 8577*
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NET-WORKS Nick Naimo, Newburgh, IN.....#1(812) 858 5405
NET-WORKS Pirate's Harbor, Boston, MA.....(617) 720 3600
NET-WORKS Pirate's Harbor, Cambridge, MA.....(617) 494 1985
NET-WORKS Pirate's Lodge, New City, NY.....(914) 634 1268
NET-WORKS Portsmouth, NH.....(603) 436 3461
NET-WORKS RJNET, Warnville, IL.....(312) 393 4755
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NET-WORKS The Dark Realm, Houston, TX.....(713) 333 2309*dd.
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NET-WORKS The System, Houston, TX.....(713) 785 7996-
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PMS - Twin Cities, Minneapolis, MN .....(612) 929 8966
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RCP/M Hackers BBS, Melbourne, FL .....!&(305) 676 3573*
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RCP/M Mission, KA.....$(913) 362 9583*
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RCP/M Olympia, WA .....(206) 357 7400*
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RCP/M RBBS Arvada Elect., Colorado Springs, CO .....!(303) 598 4662*
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RCP/M RBBS BHEC, Baltimore, MD .....(301) 661 2175*
RCP/M RBBS Cincinnati, OH .....(513) 489 0149-
RCP/M RBBS Comp. Tech. Assoc., El Paso, TX.....(915) 533 2202*
RCP/M RBBS Computron, Edmonton, Alberta, CN .....(403) 482 6854*
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RCP/M RBBS El Paso, TX.....&(915) 598 1668*
RCP/M RBBS EPSON, Braintree, MA.<pw=Epson>.....!(617) 848 8281
RCP/M RBBS EPSON, Bristol, PA.<pw=Epson>.....!(215) 788 5614
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RCP/M RBBS IBM-PC, Hawthorne, CA.....$(213) 973 2374
RCP/M RBBS IBM-PC, Orlando, FL.....$&(305) 830 4340*
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RCP/M RBBS NACS/UAH, Huntsville, AL.....(205) 895 6749*rb.
RCP/M RBBS Napa Valley, CA.....(707) 257 6502*
RCP/M RBBS Ocean, NJ.....&(201) 775 8705
RCP/M RBBS Orlando, FL.....$&(305) 671 2330*
RCP/M RBBS Pasadena, CA.....$(213) 577 9947*
RCP/M RBBS Pegasus, Houston, TX.....(713) 862 1624*
RCP/M RBBS Pickerington, OH.....(614) 837 3269
RCP/M RBBS Piconet, Mt. View, CA.....(415) 965 4097
RCP/M RBBS Pontiac, MI.....(313) 338 8505
RCP/M RBBS Paul Bogdanovich, NJ.....(201) 747 7301
RCP/M RBBS Rutgers, New Brunswick, NJ.....(201) 932 3879*
RCP/M RBBS San Diego, CA.....$&(619) 273 4354*
RCP/M RBBS San Jose Oxgate, San Jose, CA.....(408) 287 5901*
RCP/M RBBS Southfield, MI.....(313) 559 5326*
RCP/M RBBS Tampa, FL.....(813) 831 7276
RCP/M RBBS SDCS San Diego, CA.....(619) 236 0742*
RCP/M RBBS SDCS HEC#04, La Mesa, CA.....!(619) 461 5117*
RCP/M RBBS Woodstock, NY.....&(914) 679 8734*
RCP/M RBBS Yelm, Olympia, WA.....(206) 458 3086 rb.
RCP/M RBBS Rich & Famous, San Francisco, CA.....(415) 552 9968*
RCP/M RBBS Satsuma, Houston, TX.....&(713) 469 8893-
RCP/M RBBS Simi Valley, CA.....(805) 527 2219-

RCP/M RBBS SJBBS Bearsville, NY.....(914) 679 6559*rb.
RCP/M RBBS SJBBS Johnson City, NY.....(607) 797 6416-
RCP/M Software Tools, Sydney, Australia.....61 02 997 1018*
RCP/M Sunnyvale, CA.....(408) 730 8733-
RCP/M Superbrain, Lexington, MA.....$&(617) 862 0781*
RCP/M System One, Toronto, CN.....&(416) 231 9538*
RCP/M System Two, Toronto, CN.....&(416) 231 1262*
RCP/M Technical, Houston, TX.....(713) 522 3805 rb.
RCP/M Technical, Thousand Oaks, CA.....&(805) 492 5472*
RCP/M The C-Line, NJ.....(201) 625 1797-
RCP/M W. Carrolton, Dayton, OH.....(513) 435 5201*
Remote Northstar Denver, CO.....(303) 444 7231
Remote Northstar NASA, Greenbelt, MD.....(301) 344 9156
Remote Northstar Santa Barbara, CA.....(805) 964 4115
Remote Northstar Virginia Beach, VA.....(804) 340 5246
ST80-CC Lance Micklus, Inc. Burlington, VT.#1.....(802) 862 7023*
ST80-PBB Monroe Camera Shop, Monroe, NY.....(914) 782 7605
TCBBS Astrocom, New York, NY.....#1(212) 799 4649*
TCBBS B.A.M.S. New York, NY.....(212) 362 1040*
T-NET Central Processing Unit, Plymouth, MI.....(313) 453 5146*
T-NET Delta Connection, Lawrenceville, NJ.....(609) 896 2436*
T-NET Special Corp., W. Bloomfield, MI.....(313) 855 6321*
T-NET Twilight Phone, Warren, MI.....#1(313) 775 1649*
TBBS Aurora, CO.....#1(303) 690 4566
TBBS Austin, TX.....#1(512) 385 1102*
TBBS Beer City, Milwaukee, WI.....&(414) 355 8839*
TBBS Canopus, Milwaukee, WI.....(414) 281 0545*
TBBS Exity 2000, Houston, TX.....&(713) 442 7644*
TBBS Freelancin' Alvin, Houston, TX.....&(713) 331 2599*
TBBS Freelancin', Huston, TX-d.&(713) 488 2003*
TBBS Hawkins, TX.....&(214) 769 3036*
TBBS Noah's Ark, Fremont, CA.....(415) 490 8083*so.
TBBS Pizza-Net, Orlando, FL.....(305) 645 5543*
TBBS Shreveport, LA.....(318) 635 8660*
TBBS Tulsa, OK.....(918) 749 0059*
TRADE-80 Albany, GA.....(912) 439 7440*
TRADE-80 Ft. Lauderdale, FL.....#1(305) 525 1192
TRADE-80 Omaha, NE.....(402) 292 6184
Access-80, Tampa, FL.....(813) 884 1506*
(?) Queens, NY.....(212) 896 0519
Adventure BBS, Roslyn, NY.....(516) 621 9296
Alpha, Tampa, FL. .<acct#=ABCDOO, pw=TRYIT>.....(813) 969 0512*
Aphrodite-E, Patterson, NJ.....!(201) 831 1042 so.
Apollo's Chariot, Apollo, FL.....(813) 645 3669
Applecrackers, Columbus, OH.....(614) 475 9791*
Apple Crunch, Houston, TX.....(713) 468 3122

ARBB Seattle, WA.....(206) 546 6239
Atatcom/80 San Leandro, CA.....(415) 895 8980*
Atari BBS, Virginia Beach, VA.....(804) 491 1437*
Austin Party Board, Austin, TX.....(512) 442 1116*
Aviators Bulletin Board, Sacramento, CA.....(916) 393 4459
Blax-80 BBS, Phoenix, AZ.....(602) 952 1382*
BBS Apollo, Phoenix, AZ.....(602) 246 1432*
BBS Atari AMIS, Kansas City, MO.....(816) 587 9543*
BBS B.R., Los Angeles, CA.....(213) 394 5950*
BBS Colornet, Providence, RI.....$(401) 521 2626-
BBS Commodore, San Juan, PR.....(809) 781 0350-
BBS Computer Apptications Co., Poland, OH.....(216) 757 3711
BBS Gandalf #2, Heightstown, NJ.....!(609) 448 8244
BBS Heathkit Store, Warwick, RI.....(401) 738 5152-
BBS Homestead, FL.....(305) 246 1111
BBS MCUA, Houston, TX.....(713) 661 5428*
BBS Pensacola, FL.....(904) 477 8783
BBS-16 Santa Rosa, CA.....(707) 527 5908
BBS SUE Milwaukee, WI.....!(414) 327 6010
BBS The BULL, Toronto, CN.....(416) 423 3265 so.
BBS The Safehouse, Minneapolis, MN.....(612) 724 7066*
BBS-80 DALTRUG, Dallas, TX.....(214) 289 1386*
BBS Syslink, Providence, RI.....(401) 272 1138*
Big Top Games Systems, Milwaukee, WI.....(414) 259 9475
Bird House, San Jose, CA.....(408) 267 7399
Boston Information Exchange, Boston, MA.....&(617) 423 6985*
Bradley Computer BBS, Tampa, FL.....(813) 734 7103
BSBB Tampa, FL.....(813) 885 6187
Capital City BBS, Albany, NY.....(518) 346 3596*
Cass-80 Hickory Hills, IL.....(312) 598 4861
C.M.M.S. Chicago, IL.....(312) 957 3924*
C-HUG Bulletin Board, Fairfax, VA.....(703) 360 3812*
Cohoes Forum, Cohoes, NY.....(518) 235 9073
COLOUR-80, Orange Park, FL.....(904) 264 0335*
Commodore Video King, Skokie, IL.....(312) 674 6502
Compuque-80, Houston, TX.....&(713) 444 7041*
Compusystems, Columbia, SC.....(803) 771 0922
Computer Connection, Beverly Hills, CA.....(213) 657 1799
Computers for Christ, Ontario, CA.....(714) 983 9923*
Creepy Corridors, Phoenix, AZ.....(602) 956 5021-
CVBBS #1, San Diego, CA.....(619) 691 8367*
CVBBS #2, San Diego, CA.....(619) 278 9114
Datamate, Canoga Park, CA.....#1(213) 998 7992 so.
Diamond III, Phoenix, AZ.....(602) 890 0972*
Dimension-80 Orange, CA.....(714) 974 9788
Download-80 Mojo's, Forest Knolls, CA.....&(415) 488 9145*

Dragon's Lair, Long Beach, CA.....(213) 428 5206
Drummer, San Francisco, CA.....(415) 552 7671 so.
EMC-80 St. Louis, MO.....(314) 645 1047
Experimental-80 Kansas City, MO.....(913) 676 3613
FBBS #1, Purdue, IN.....&$(317) 494 6643*
Future Tech, Alexandria, VA.....!(703) 451 4893*
GBBSII Sullivan, CO.....(303) 693 1064-
GBBSII Apple PI, Bloomfield, CO.....(303) 469 7541*
GBBSII Aurora-Net, Denver, CO.....(303) 343 8401*
GBBSII Eamon, Sullivan, CO.....$(303) 750 3783-
GBBSII Off The Wall, Boulder, CO.....(303) 443 3367*.
Genesys, Phoenix, AZ.....(602) 967 4529*
Grape Line BBS, Napa Valley, CA.....(707) 538 9124*
Hermes-80 Allentown, PA.....(215) 434 3998
HEX Silver Spring, MD.....%(301) 593 7033*
H&S Microsystems, Burnaby, B.C.....!(604) 430 4145-
IBM PC No-Name, San Lorenzo, CA.....!(415) 481 0252*
INFOEX-80 West Palm Beach, FL.....(305) 683 6044*
INFOEX-80 Akron, OH.....(216) 724 2125*
INFOEX-80 Tulsa, OK.....(918) 838 8698*
Interface BBS (Atari), Chicago, IL.....(312) 296 3883
Irvine Line, Irvine, CA.....(714) 551 4336
JCTS Redmond, WA.....(206) 883 0403*
L.A. Interchange, Los Angeles, CA.....(213) 631 3186*
Lethbridge Gaming system, Lethbridge, AB.....(403) 320 6923
Living BBS, Education SIG.....(415) 565 3037
Mages Inn, Omaha, NE.....(402) 734 4748*
Magus, Herndon, VA.....(703) 471 0611*
Mail Board-82 Seattle, WA.....(206) 527 0897*
Masspet BBS, East Taunton, MA.....!(617) 824 4878-
MBBS, Mission, BC, CN.....!(604) 462 8633-
Micro-Com, Cincinnati, OH.....!(513) 671 2753
Micro-Com, Louisville, OH.....(216) 875 4582*
Micro-80 West Palm Beach, FL.....(305) 686 3695
Micro Informer, Tampa, FL.....(813) 875 3331
Microsystems, Phoenix, AZ.....(602) 938 4508*
Midwest, St. Louis, MO.....(314) 227 4312 so.
Mini-Bin Seattle, WA.....(206) 762 5141*
MMMMMM#1, Santa Monica, CA.....(213) 390 3239-so.
MMMMMM#2, New York, NY.....(212) 541 5975-so.
MMMMMM#3, Marina del Rey, CA.....(213) 452 6111-so.
MMMMMM#4, Lawndale, CA.....(213) 821 2257-so.
Motherboard, San Leandro, CA.....(415) 352 8442
MRC BBS, Mountain View, CA.....!(415) 968 1093
NBBS Norfolk, VA.....(804) 444 3392
North Orange Country Computer Club, Orange, CA.....(714) 633 5240

Novation CO., Los Angeles, CA . . . .<pass=CAT>.....(213) 881 6880
Nibble One, Schenectady, NY.....(518) 370 8343
NWLAIBMPCUG, Shreveport, LA.....(318) 688 7078
NWWCUG Edmunds, Seatle, WA.....(206) 743 6021
Nybbles-80, Queens, NY.....(212) 626 0375
OACPM Omaha, NE.....(402) 292 9598*
OARCS Portland, OR.....(503) 641 2798
OCTUG Orange County, Garden Grove, CA.....(714) 530 8226
Omega, Phoenix, AZ.....(602) 952 2018*
Oracle North Hollywood, CA.....(213) 980 5643 so.
Orange County Dta Exchange, Garden Grove, CA.....(714) 537 7913
OS-9 6809 BBS, Palatine, IL.....(312) 397 8308
PBBS Arc-Net, Little Rock, AR.....(501) 372 0576*
PBBS Co-operative Comp Svc, Palatine, IL.....(312) 359 9450*
Personal Msg. System-80, Deerfield Bch, FL.....&(305) 427 6300*
PHOTO-80, Haledon, NJ.....(201) 790 6795
PMBBS, Humble, TX.....(713) 441 4032
RACS V Fullerton, CA.....(714) 524 1228
RBBS Milwaukee-Chicago Line, IL.....(312) 876 0974
RBBS The Meeting Place, Omaha, NE.....!&(402) 734 6959*dl.
RBBS Upland, CA.....!(714) 981 3787*dl.
RIBBS Houston, TX.....(713) 497 5433
R.I.C.A.M.I.S., Kingston, RI.....(401) 456 8250*
RI Tandy Users Group, Cranston, RI.....(401) 944 4689*
RS-CPM Clarksville, MI.....(616) 693 2648
SATUG BBS, San Antonio, TX.....(512) 494 0285
Satyricon, Burnaby, BC, CN.....!(604) 438 2468*
S.D.A.C.E., La Mesa, CA.....!(619) 447 8143
Seacomm-80 Seattle, WA.....(206) 763 8879*
SIGNON Reno, NV.....<pw=FREE>.....(702) 826 7234
$(702) 826 7277
SISTER Staten Island, NY.....(212) 442 3874*
SOBBS Poor Man's BBS, Houston, TX.....(713) 453 7931*
SOBBS Test Mode, Houston, TX.....(713) 522 5516
Stellar III, Phoenix, AZ.....(602) 833 0740*
Steve's BBS/Game Palace, Shawnee Mission, KS.....(913) 648 5301*
Stuart II BBS, Boulder Creek, CA.....!(408) 338 9511*
Sunrise Omega-80, Oakland, CA.....(415) 452 0350
Switchboard, Alexandria, VA.....(703) 765 2161*
System/80 San Leandro, CA.....!(415) 782 4402
Talk-80 ROBB, Portsmouth, VA.....(804) 484 9636
TCUG BBS, Washington, DC.....(703) 836 0384*
Tech-Link, Forest Glen, MD.....(301) 565 9051*
TECOM-80, Tampa, FL.....(813) 839 6746
Telcom 7 New Fairfield, CT.....(203) 746 5763*
Telemessage-80, Atlanta, GA.....(404) 962 0616

The Garden of Eden, Phoenix, AZ .....(602) 991 0144*
The Interface, Los Angeles, CA .....(213) 477 4605
The Software Bank, Northridge, CA .....!(213) 701 7670
Toledo Apple Users BBS, Toledo, OH .....!(419) 537 9777*
Treasure Island, Royal Oak, MI .....(313) 547 7903
TVG Systems, Burnaby, BC, CN .....!(604) 738 1640*
Vanmil, Milwaukee, WI .....(414) 271 7580*
VERGA 80, Santa Ana, CA .....(714) 547 6220
Voyager, Phoenix, AZ .....(602) 247 6034
Vic-20 Online, Houston, TX .....(713) 944 6597*
Visiboard, Wellesley, MA .....(617) 235 5082
WAPABBS, Charlotte, NC .....(704) 373 7966*
Westside Download, Detroit, MI .....!(313) 348 4479
XIO, Houston, TX .....(713) 495 1422-/ex

Appendix C

Magazines

A+—Called the "Independent Guide for Apple Computing," this monthly magazine includes articles, reviews, and evaluations of products and items of interest to Apple owners. It contains a section that deals with the Macintosh, and contains articles about programming, technical issues, products, and tips. It is published by:

Ziff-Davis Publishing Company
One Park Ave.
New York, NY 10016

Infoworld—A weekly newspaper about microcomputers, valuable for keeping up with new developments on a week-by-week basis. Most computer stores and larger bookstores carry *Infoworld.* The address is:

InfoWorld
Circulation Dept.
Box 837
Framingham, MA 91701

Microcomputing—A monthly general-interest computer magazine, geared to the computing novice. Published by:

Wayne Green Inc.
Box 981
Farmingdale, NY 11737

MACazine—A useful magazine for the Macintosh owner. It contains product reviews, product comparisons, information about Macintosh developers, gossip about Apple Computer, Inc., programming tips, and lots of other information in a very easy to use format. The annual subscription rate is $18.00.

ICON CONCEPTS CORPORATION
The MACazine
P.O. Box 1936
Austin, TX 75751

MACWORLD—The definitive magazine for the Macintosh owner. This magazine was launched at the same time as the Macintosh. It contains in-depth discussions about products that can be used on the Macintosh. It also contains tips on how to use the Macintosh and the hardware and software used by the Macintosh. It contains artwork done on the Macintosh. It is a really slick, richly illustrated magazine about the Macintosh.

Macworld
Subscription Department
P.O. Box 20300
Bergenfield, NJ 07621

Nibble—Considered by many, including us, to be THE magazine for the Apple computer. *Nibble* emphasizes program listings, which you can key in yourself, ranging from the business-oriented to games to outright craziness. *Nibble* currently contains a section that deals with the Macintosh, and contains timely articles about products that can be used by the Macintosh. It also contains program listings in Pascal and in MicroSoft BASIC for readers who are interested in learning to write programs. A separate magazine called *Nibble Mac* was to have been published in the first part of 1986. The subscription rate for this magazine will be $16.95 for 12 issues.

Nibble Magazine
45 Winthrop St.
Concord, MA 01742

Appendix D

Suppliers

Anchor Automation, Inc.
6913 Valjean Ave.
Van Nuys, CA 92514
818-997-6493
Volksmodem

Apple Computer, Inc.
20525 Mariani Ave.
Cupertino, CA 95014
408-996-1010
ImageWriter, LaserWriter, Apple Daisy Wheel printers; Apple Modem; Macintosh External Disk Drive; AppleTalk LAN; Apple Memory Upgrade; Apple Mouse

Applied Creative Technology, Inc.
2156 W. Northwest Hwy., Ms 303
Dallas, TX 75220
800-433-5373
214-556-2916
Printer Optimizer controller/buffer

Assimilation Process
485 Alberto Way
Los Gatos, CA 95030
408-356-6241
Mac Turbo Touch graphics tablet

C. Itoh Digital Products
5301 Beethoven St.
Los Angeles, CA 90066
F-10 Printmaster printer

Centa Systems, Inc.
5308 Derry Ave., Suite C
Agoura Hills, CA 91301
818-889-6246
Centa 512K Upgrade

Comrex International Inc.
3701 Skypark Dr. Suite 120
Torrance, CA 90505
213-373-0280
CR-II, CR-III printers

Comtrex Ltd.
P.O. Box 5500
Newport Beach, CA 92662
714-673-4200
MacMonitor

Corvus Systems, Inc.
2029 O'Toole Ave.
San Jose, CA 95131
408-946-7700
OmniDrive hard drive

Cuesta Systems, Inc.
3440 Roberto Court
San Luis Obispo, CA 93401
805-541-4161
Datasaver standby power system

Diablo Systems Incorporated
P.O. Box 5030
Fremont, CA 94537
415-498-7000
Diablo 630 ECS printer

Discwasher
1407 N. Providence Rd.
Columbia, MO 65205
314-449-0941
Spikemaster surge protector

Dresselhaus Computer Products
837E Alcosta Ave.
Glendora, CA 91740
818-914-5831
AYN Interface

Dynax, Inc.
5698 Bandini Blvd.
Bell, CA 90201
213-260-7121
DX-15 printer

EPD, Inc.
P.O. Box 673
Waltham, WA 02254
617-891-6602
Lemon/Lime/Peach/Orange surge protectors

Epson America, Inc.
3415 Kashiwa St.
Torrance, CA 90505
213-539-9140
Epson FX-80+, FX-100+, LQ-100 printers

GDT Software, Inc.
Suite D
2800 Douglas Rd.
Burnaby, B.C. Canada
Y5C 5BM
The Print-Link software

General Computer Co.
215 First St.
Cambridge, MA 02142
800-422-0101
617-492-5500
HyperDrive hard drive

GTCO Corporation
1055 First St.
Rockville, MD 20850
301-279-9550
Macintizer graphics tablet

Haba Systems, Inc.
15154 Stagg St.
Van Nuys, CA 91405
818-989-5822
Haba disk drive

HanZon Data Inc.
18732 142nd Ave. NE
Woodinville, WA 98072
HanZon Universal Serial Interface Card; Universal Data Buffer

Hayes Microcomputing Products, Inc.
5923 Peachtree Industrial Blvd.
Norcross, GA 30092
404-449-8791
Hayes Smartmodem 300, 1200, 2400

Houston Instrument
8500 Cameron Rd.
Austin, TX 78753
512-835-0900
DMP-29, DMP-40 plotters

I/O Video, Inc.
255 Third St.
Cambridge, MA 02142
617-547-4141
Mac Private Eye video digitizer

Interactive Structures, Inc.
146 Montgomery Ave.
Bala Cynwyd, PA 19004
215-667-1713
SC14 Signal Conditioners

IOMEGA Corporation
1821 West 4000 So.
Roy, UT 84067
801-776-7330
Bernoulli Box hard drive

Koala Technologies Corp.
3100 Patrick Henry Dr.
Santa Clara, CA 95052
408-986-8866
MacVision video digitizer; KAT touch tablet

Leading Edge Products, Inc.
225 Turnpike St.
Canton, MA 02021
800-343-6833
distributor of C. Itoh printers

Mass Tech Development Labs Inc.
451 Boston Rd.
Groton, MA 01450
617-448-3450
Mass Tech 512K Upgrade

Mentauris Technologies
P.O. Box 1467
San Marcos, TX 78666
512-396-1565
Mentauris Composite Video Adapter

Mesa Graphics
P.O. Box 506
Los Alamos, NM 87544
Plot-It software

Micro Conversions
3606 Knoll Crest Drive
Arlington, TX 76014
817-465-5758
Micro Conversions 512K Upgrade

Micro-Design
6301 Manchaca Rd.
Austin, TX 78745
800-531-5002
512-441-7890
The Keeper series hard drives and LAN

Micron Technology, Inc.
Systems Group
1447 Tyrell Lane
Boise, ID 83706
208-386-3800
MicronEye video digitizer w/ input source

Microsoft Corporation
10700 Northrup Way
P.O. Box 97200
Bellevue, WA 98009
206-828-8080
MacEnhancer serial/parallel expansion device

Mouse Systems
2336H Walsh Ave.
Santa Clara, CA 95051
408-988-0211
A+ Optical Mouse

New Image Technologies, Inc.
10300 Greenbelt Rd. #104
Seabrook, MD 20706
301-464-3100
Magic video digitizer

Novation, Inc.
20409 Prairie St.
Chatsworth, CA 91311
818-996-5060
Smart-Cat plus modem

Panamax
150 Mitchell Blvd.
San Rafael, CA 94930
415-472-5547
The MAX 5512 surge protector

Paradise Systems, Inc.
150 North Hill Rd.
Brisbane, CA 94005
800-822-2020
415-527-7977
Paradise Mac 10 hard drive

Personal Computer Peripherals Corp.
6204 Benjamin Rd.
Tampa, FL 33614
800-622-2888
813-884-3082
Macbottom hard drive

Personics Corp.
747 Main St. #224
Concord, MA 01742
617-371-1904
View Control System sight controller

Practical Peripherals
31245 La Baya Dr.
Westlake Village, CA 91362
213-991-8200
MBIS Microbuffer

Prentice Corp.
266 Caspian Dr.
Sunnyvale, CA 94086
408-734-9810
POPCOM X100 modem

Professional Data Systems
20 Sunnyside Ave.
Mill Valley, CA 94941
415-383-5537
PDS Big Mac Monitor

Prometheus Products, Inc.
45277 Fremont Blvd.
Fremont, CA 94538
415-490-2370
ProModem 1200

PTI Industries
320 River St.
Santa Cruz, CA 95060
408-662-3422
DataShield PC-200, XT-300 standby power systems; DataShield Model 100 surge protector

Quark
2525 W. Evans, Suite 220
Denver, CO 80219-5554
303-934-2211
QC10 hard drive

RTC DELTEC Corp.
2727 Kurtz St.
San Diego, CA 92110
800-854-2658
Micro-UPS, Model 3056

Servidyne Micro Systems Inc.
1735 DeFoor Place NW
Atlanta, GA 30377
404-352-2050
Micro-Imager video digitizer

Silver Reed America, Inc.
19600 So. Vermont Ave.
Torrance, CA 90502
800-252-7760
EXP-500 printer

Sola Electric
1717 Bresse Rd.
Elk Grove Village, IL 60007
312-439-2800
Minicomputer Regulators; Mini UPS; Power Line Monitor, SPS

Star Micronics, Inc.
200 Park Ave.
New York, NY 10166
212-986-6770
Delta 10, 15,Gemini 10X, 15X dot-matrix printers

Summagraphics
777 State St. Ext.
Fairfield, CN 06430
203-384-1344
MacTablet high-resolution graphics tablet

Tecmar, Inc.
6225 Cochran Rd.
Solon, OH 44139-3377
216-349-0600
MacDrive hard drive

Teletex Communications Corp.
3420 E. Third Ave.
Foster City, CA 94404
415-341-1300
TTXpress printer

Thunderware, Inc.
21 Orinda Way
Orinda, CA 94563
415-254-6581
ThunderScan optical scanner

Topaz, Inc.
9192 Topas Way
San Diego, CA 92123-1165
619-279-0837
Powermaker Micro UPS

U.S. Robotics, Inc.
1123 Washington Blvd.
Chicago, IL 60607
312-733-0497
Password modem

Video 7
550 Sycamore Dr.
Milpitas, CA 95053
408-943-0101
Mouse Stick joystick

Glossary

Glossary

acoustic coupler—A cradle device used to connect the telephone receiver to the computer.

A/D—Analog to digital converter; a circuit that translates an analog signal into digital quantities.

analog—Any process that changes steadily and may appear irregular and sudden, but never instantaneous.

analog touch tablet technology—A touch tablet returning a value between 0 and 255 depending on where pressure is being placed on the tablet.

answerback—The specific character or two from a computer indicating it is ready for data transmission. This character can be typed in manually by the operator, or be an automatic feature of the modem.

application—Any stand-alone software that may be used by the Macintosh for the benefit of the computer's user. Applications include drawing programs, spreadsheets, word processors, database managers, and thought processors.

ASCII—A commonly used standard list of numbers representing alphanumeric characters.

auto answer—A feature on some modems that allows it to automatically answer and respond to incoming calls.

auto-dial—A feature on some modems for automatically dialing an information source.

auto line feed—A printing mode in which each time the printer executes a carriage return, it also does a line feed, preventing overprinting of data.

backup—A duplicate copy of a program or data stored on a different diskette or tape in case of loss or damage to the original.

band width—The maximum rate at which a monitor or television set can accept data from the computer. It is measured in MegaHertz (MHz).

baud rate—The measure of the speed of serial data transfer bits per second (bps). Since each data character consists of approximately 10 bits, including start and stop bits, divide by 10 to get the approximate character per second (cps) transfer rate.

beam convergence—The precise meeting of the beams that strike the pixels.

Bell 103—A low-speed modem developed by Bell Laboratories.

Bell 212A—A high-speed modem developed by Bell Laboratories.

bidirectional—Indicates the print head prints in both directions. A typewriter prints only in one direction.

block graphic characters—Larger than normal characters for headings, titles, etc.

bps—Bits per second.

buffer—A memory device that stores data until the printer is ready to print it. The buffer may be located within the printer, in the printer interface, in a separate unit, or as part of the computer's RAM.

bulletin board—An information source providing local information.

cache memory—A high-speed buffer used jointly by the computer and the hard disk. The hard disk achieves a faster average access by holding data in its cache memory in case it is needed again. Some cache memories also use a read-ahead and exchange that attempts to read data into the cache memory before it is requested by the computer. This feature can speed up access to sequential or partially sequential data.

Centronics parallel—A parallel data bus for transfer of data from a microcomputer to a printer invented by the Centronics Company. It is the industry standard for parallel data transfer.

character generator—The section in ROM that contains information and instructions needed to create characters on the screen. Character generator chips are used in a large number of computers; however, the Macintosh does not use a character generator per se to produce characters that are printed to the screen. Instead, fonts are stored in the System file in the System folder. These fonts are made available to all programs resident on the disk containing a System folder or all programs resident on a nonboot disk that is using a boot disk to control disk-to-computer transactions.

chroma line—The path along which information for creating images in color is sent to the computer.

composite video—A type of color monitor where information for the images is sent to the computer through only one line, the chroma line.

compressed print—A print mode where the width of characters is reduced.

contrast—A knob on the monitor to vary the difference between the light intensity of the image and its background.

control character—Any character which has been given a specific purpose, such

as beginning or ending the transmission of data or responding to an incoming call.

contiguous memory—Memory that is treated as a unit by the applications employing it. Access to all parts of this electronic memory is unbroken by special utilization of the middle portion of the memory or the upper portion of the memory as it was originally configured.

correspondence mode—Available on some dot-matrix printers, it enables you to print near-letter-quality material. The quality of the print depends on the printer.

cps—Characters per second.

CRT—Cathode ray tube; the most common form of computer display screen; the 'picture tube' used to display images.

D/A—Digital-to-analog converter; converts digital signals to analog signals.

daisy-wheel printer—A printer using a printing element that resembles a daisy—individual spokes containing the various characters on the end. The wheel spins and is pressed by the hammer when the proper letter is in front of the hammer. Daisy-wheel printers, using fully formed characters, closely resemble the output from electric typewriters in quality.

data communication—Transmitting and receiving data to or from remote systems.

data transfer rate—The rate at which data is transferred from one place to another, such as disk to memory; often expressed in bits per second.

DB-5, DB-9 and DB-25—Connectors for 5, 9, and 25 wire data busses, respectively.

descenders—The bottom portion of lowercase characters that are below the print line (g, j, p, q and y). Upper and lowercase letters use the top seven rows of dots. The letters with descenders need rows 8 and 9 to appear fully formed. On a 5-×-7 matrix descenders are all above the print line and look odd.

desktop—A convenient representation of the disks currently being used by a Macintosh, the applications and files contained on each such disk, and the commands and features available to the Macintosh user. The Macintosh desktop display consists of a menu bar that stretches across the top of the screen and makes various commands and features available to the user; icons that represent the disks currently being used by the Macintosh and also represent the various programs and files contained on such disks; windows that are employed by the finder or the current application, and a trash can that is used to erase files from a disk. All file management functions are carried out from the desktop.

desktop accessory—One of the menus available from the menu bar that is displayed at the top of the Macintosh screen display is an Apple menu. When this menu is accessed by the user, a menu containing a variety of tools is made available to the user. These tools can include the software that is used to control a video digitizer and to manipulate and enhance the images produced by the digitizer. The tools that are provided to the user via the Apple menu are the desktop accessories.

digital—Combinations of discrete binary units, as contrasted with representation by a continuously changing function.

digital recording—Recording sound from sound intensity samples, represented

by discrete multiples of unitary value.

digital touch tablet technology—A touch tablet returning an on/off signal for each location on the tablet, and able to report several locations on the tablet being pressed at one time.

DIP—Dual in-line packet; refers to the fact that the pins are arranged in two parallel lines.

DIP switches—A series of switches inserted into an electrical circuit and used to select options on a circuit board. Each switch has a separate on/off position. The pins on the switches are in the same configuration as the pins on DIP chips.

direct connect—Indicates the modem is connected directly to the computer.

directory—A listing of each file and program on a disk. Directories are displayed within a window on the Macintosh desktop display. They can be viewed by icon, by name alphabetically, by file type, by file size, and by date of file modification. Each of these options may be selected from the View Menu.

disk—Also called diskette; a flat, flexible mylar disk which is contained within a protective cover and on which data is recorded magnetically.

disk drive—The peripheral device used to either record onto the disk or read data from the disk.

document—A file produced by applications software used on the Macintosh.

dot-graphics—The number of dots per inch a device is able to produce. The more dots per inch, the better the graphics resolution.

dot-matrix—A method of forming characters by using a rectangular matrix of dots (5 × 7 dots, 8 × 8 dots, 9 × 9 dots, etc). Characters are created progressively, rather than all at once.

dot pitch—The distance between the perforations on the shadow mask.

double-sided—Indicates that both sides of the disk are capable of storing data.

double-strike—A print mode where a character is printed twice, one character on top of the other. The resulting character appears darker and sharper.

dpi—Dots per inch.

electron gun—The device that shoots the beam through the tube to the screen.

EMI—ElectroMagnetic Interference.

emphasized print—A print mode where a character is printed once, and then again slightly to the side, giving the character the appearance of being emphasized.

EPROM—Eraseable, Programmable, Read-Only Memory; a chip that holds programs which are normally not changeable. The programs on the EPROM can be erased using special ultraviolet light erasers and then reprogrammed using a prom burner.

error message—A message displayed on the screen to inform the user that some problem has occurred while the drive was functioning. Macintosh error messages are displayed within dialog boxes (boxes which offer the user one or more courses of action to continue) and within alert boxes (boxes which offer only one course of action, usually not to continue).

escape sequences—A series of command codes generally starting with ASCII code 27. They are directed to the printer by software and instruct the printer to perform a function such as underline or change to boldface.

expanded print—A print mode where characters are spread out and the actual width of the character is increased.

expansion board modem—Indicates the modem is installed inside the computer. Also called an internal modem. All Macintosh modems must be external to the computer.

external—A term used to describe a hard disk that has its own cabinet and is not located inside the computer console. It is attached to the computer by an external cable.

fanfold paper—Continuous sheets of paper joined by perforations and folded in a zigzag fashion. The paper runs through the printer and folds by itself.

FET—Field Effect Transistors.

fill/draw software—Programs that permit the drawing of shapes on the graphics screen using the appropriate pointing device and the filling in of closed shapes with colors or patterns. MacPaint is a sophisticated example of such software.

filter—A device used in telecommunications that allows signals of specific frequencies to pass without significant attenuation, whereas other frequencies are strongly attenuated.

finder—Macintosh's disk operating system. The finder is included in the System folder of any disk that will boot when it is inserted into a disk drive. It manages the documents and applications which are stored on disk; allows files and documents to be copied, deleted, and duplicated; and arranges for a directory of each application, file, and document to be written on each disk for use in file management.

firmware—A program on a ROM, PROM, or EPROM, so called to differentiate it from software, which is more readily modifiable.

fixed disk—Hard disk.

fixed media—Media that cannot be removed from the device. Hard disks use fixed media.

floppy—Refers to the flexible mylar disk used for mass storage.

font—Style of characters; i.e., Geneva, and Chicago. Macintosh fonts are contained within the System file in the System folder on each disk. They may be changed readily by using a utility program called the Font Mover, supplied by Apple on the Macintosh System Disk. Each program uses the fonts that are stored in this file.

footprint—The space on the table or desktop that is occupied by the components of the system resting on it.

formant synthesis—Simulates electronically simple frequencies and then modifies them, through filters, to simulate complex sounds. Depending on the nature of the material vibrating, different objects emphasize particular harmonics over others. Harmonics are integral multiples of primary frequency and the dominant harmonics are called formants.

format—A technique for labeling the file marks, track marks, address marks, checksums, and headers on a disk. Formats are not the same in each system, and a disk must be formatted for your system before it can be used to store data or programs.

form feed—A button on some printers to automatically advance the paper to the top of the next page. It can also sometimes be activated by sending the printer ASCII code 12.

friction feed—A means to feed paper into the printer using pressure against the roller. Typewriters function in this manner.

full duplex—The ability of the modem to send and receive information simultaneously.

graphics dump—A program for printing the picture from a graphics screen. Most dot-matrix printouts of the Macintosh screen are screen dumps. Letter-quality output is straight ASCII character transfer from computer to printer.

grid—A pad that sits on the work surface next to the computer, usually made out of plastic or metal and measuring approximately 12 × 12 inches. This surface is covered with lines, which are read optically by the mouse. An optical mouse uses these lines to calculate the distance it is moving and its current position in relation to the screen.

half duplex—The ability of the modem to either send or receive data, but not at the same time.

handshaking—A basic communication technique between a printer or other peripheral device and the computer indicating its readiness to accept data.

hard-sectored—Indicates that the recording surface of the disk is permanently marked by sectors.

harmonic—A sinusoidal wave whose frequency is a multiple of the fundamental frequency, which determines the tone or quality of sound.

high-resolution graphics—A mode on some printers used to create graphic images. Dot density (60 × 72, 72 × 72 or 120 × 72) determines the degree of resolution.

high-resolution mode—The ability of the computer to individually program and display highly detailed graphics.

horizontal—A line parallel to the horizon.

horizontal register—A register, when activated by a signal from the light pen, that latches in the horizontal location of the electron beam.

IEEE—An industry standard communications protocol often referred to as IEEE-488; it allows parallel data transmission between multiple devices, each identified by a unique identification number.

input device—Any item of equipment that permits data and instructions to be entered into a computer's central memory, i.e., keyboards, terminals, joysticks, and light pens.

interface—A device used to connect the computer and a printer or other peripheral through a serial or parallel port. All parts of this connection must be compatible.

internal—A term used to describe a hard disk drive that inserts into the main console of the computer. The HyperDrive is an example of such a hard disk system.

interrupt—A signal to the central processor to save its current position in the currently running task and execute the code from the interrupt handling routine.

Following the execution of this routine, the processor goes back to the interrupted program at the place it left off.

inverted—The process when printing a graphics picture of printing each white dot as black instead of each black dot as black.

letter-quality—Indicating that the characters printed appear fully formed as on a typewriter, and the print could be used for more important documents.

linear predictive coding—A technique for analyzing speech and converting it into digital code.

line feed—A button on some printers to automatically advance the paper one line.

load—A term indicating the transfer of data from storage (disk or tape) into the computer's memory.

logic-seeking—A feature which examines the content of the next line or two to determine whether to return the carriage or wait to print the following line backwards across the page. A bidirectional printer without the logic-seeking feature will miss many opportunities to print backwards when a blank line or other formatting feature of the text intervenes.

loopback—A test to see if the modem is correctly transmitting data.

low-pass filter—A wave filter that allows those frequencies below a certain critical frequency to pass and excludes all those above this point.

matrix size—The number of dots used to form one character.

megabyte—One million bytes of eight million bits (one byte equals eight bits).

memory expansion—The addition of memory capacity to a computer to give the computer more power or to provide space for a RAM disk application.

mirror drawing—A form of drawing used mainly by light pens in which each movement of the pen is mirrored in another section of the graphics screen. MacPaint uses such a routine with the mouse when Brush Mirrors are invoked from the Goodies menu on the menu bar at the top of the Macintosh screen display.

modem—MOdulator/DEModulator. The device that modulates digital signals into analog signals and demodulates analog signals into digital signals.

modem port—The port on the back panel of the Macintosh identified with a telephone icon. This port is normally used to connect the Macintosh to a modem. If this port is occupied by another peripheral, you can use the printer port to connect a modem since it is also a serial interface port.

modulation—Converting steady states to frequencies.

monitor—The screen used to display images generated by the computer.

monochrome—Using one color or shades of one color.

MOV—Metal Oxide Varister; a component used in line-filtering devices to protect against surges. Its effectiveness diminishes with use.

MTBF—Mean Time Between Failures; used to measure the effectiveness of a battery between power failures.

multiplexer—A device that accepts low-speed input from a number of different terminals and gathers them into one stream of high-speed data which is then simultaneously transmitted on a single channel. At the end of the line a demultiplexer converts this data back into low-speed input.

network—A group of computers that communicate over telephone lines or other air waves.

node—Any workstation or device that is connected to the network. Computers, printers, file servers, and mass-storage devices included in the network may be considered as nodes.

noise—Refers, in telecommunications, to unwanted, usually random, electronic signals.

nonvolatile memory—Special RAM that holds the data contained in it when the power is turned off.

normal pitch—Ten characters per inch.

on line—Indicates the printer is connected and data can be sent, as opposed to off line, where the printer is not ready to receive data for some reason.

operating system—Software contained in a computer or hard disk system that allows it to control the sequencing and processing of programs and so respond correctly to user requests, for example, to store a file of data or to compile and run a program.

optical digitizer—A peripheral that depends upon an optical scanning device to provide data to the digitizer for conversion into an image a computer can understand and manipulate. ThunderScan is an example of such a digitizing system.

output device—Any device capable of receiving information from a central processor. It may be some form of backing storage, or a peripheral unit which "translates" information into another medium.

paper-out light—Indicates the printer is out of paper. It will usually stop at this point until the paper is replaced.

parallel—A method of transmitting eight bits of data simultaneously. Parallel connections have eight wires to carry each of the eight bits of a byte. See *serial.*

parallel/serial converter—A device that accepts a parallel plug and parallel transmission of data from a computer or other source, converts it to a serial transmission, and directs it to a serial device through a serial cable.

parity—A means of ensuring data integrity when data is transmitted serially. The parity bit is set to either 0 or 1 depending on whether an odd or even number of 1 bits were sent and whether parity is set to odd or even parity.

phosphor persistence—The length of the glow of each character on a CRT.

pin feed—A method of feeding paper which uses pins on either side of the roller to carry paper with holes along the side, called sprocket paper.

pixels—Dots that are turned on and off to produce images on a computer screen.

port—An input/output connection on a computer that facilitates the direct connection of a peripheral. The Macintosh's back panel contains a mouse port, a disk drive port, two serial ports, and an audio out port.

printer control codes—Special codes that the printer interprets as instructions rather than characters to print. Examples of functions indicated by control codes include change of fonts, boldfacing, and skip to top of page.

printer spooler—Software that partitions part of a computer's memory or a hard disk's storage space to hold documents being directed to a printer by a computer.

Printer spoolers make computer use more efficient since the printing speed of the printer determines how fast data is transferred from a computer to a printer. A spooler returns the use of a computer to its user as soon as the document has been staged in the memory or storage space allocated to the spooler.

print wheel—A generic term for a type of character printing device such as a daisy-wheel or thimble.

program listing—A printout of the source code of a computer program; often includes diagnostic aids and charts.

protocol—The rules used to control the exchange of data between devices.

quad-density—Indicates the disk is capable of storing four times the amount of data as a single disk.

RAM—Random Access Memory; a term applied to the nonpermanent memory of a computer system. It is sometimes called dynamic memory since its contents may be changed by the program or programming language in use and its contents will be lost when the computer's power is turned off.

RAM disk—The use of a portion of RAM as a superfast disk drive. Data saved on the RAM disk must be transferred to a more permanent floppy disk before power is turned off or the contents of the RAM disk will be lost.

random access—A technique for going directly to a particular item, or address, in memory without the need to start at the beginning and go through each item in sequence.

raster scan—The technique of creating images using a beam to repeatedly pass across the screen.

read—To sense the data which has been recorded on a disk or other storage medium so it can be copied.

refresh rate—The rate at which a CRT's electron gun makes a complete scan of the screen.

release—The amount of time required for a sound to become silent from a mid-range intensity.

remote database—An information source that can be accessed only with a modem or other telecommunications equipment.

removable media—Media such as diskettes, cartridges, and cassettes that can be removed from the device.

resolution—Direction related to the number of pixels on the screen surface. A high-resolution monitor has many more addressable pixels than a low-resolution monitor. A more intricate and detailed image can be produced with more pixels; however, resolution is also affected by the software being used and the overall quality of the monitor.

resonance—The condition of a circuit in which the capacitive- and inductive-reactance components are equal. This condition is attained only for a comparatively narrow band of frequencies for given component values, and is propagated through any medium capable of vibrating.

RGB—Red, Green, Blue; a type of color monitor that uses three signals to control three electron guns, instead of one.

rigid disk—Hard disk.

RS-232C—The name of the electrical standard for serial data communication between devices. This type of connection is widely used in modems.

rubber band lines—A technique of graphics drawing in which the potential line or shape is shown on the screen in a moving line, which is set down on the screen when a button is pressed on the drawing device. MacPaint and MacDraw use this technique to draw lines and shapes. The technique uses the first click of the mouse button to anchor one end of a line or one corner of a shape. The line or shape is then stretched to the extremity desired by the user and the mouse button is clicked again to complete the line or shape being drawn.

save—To permanently store data onto a disk or other medium.

scanning—The process used by the various input devices to generate an image for a digitizer. A video camera generates signals by scanning the document, person, or object that is the subject to be converted to a computer image by the digitizer. An optical scanner must be passed over the document to be handled by the digitizer.

screen dump—A program for transferring either the text or graphics screen to the printer.

screen resolution—Indicates the amount of pixels a screen is able to display.

sector—A section of the track on a disk.

self-centering—The ability of a joystick, through the use of springs, to return to the center location.

self-test—A procedure whereby a device verifies if it is working properly and notifies the user appropriately.

sequential access—A method of scanning data starting at the beginning of the data.

serial—Transmission of data where one wire is used to send one bit at a time. A serial device must collect all eight bits to form one byte. See *parallel.*

serial/parallel converter—A device that converts a serial transmission sent through a serial connecting cable to a parallel transmission and sends it to a second device such as a printer through a parallel connecting cable. Such a device is required to connect a Macintosh to a parallel printer. This device may be part of an external buffer, may be a stand-alone external device, or may be a special card that is installed in the printer.

shadow mask—A perforated filter set behind the screen, through which the beams pass on their way to the pixels.

single-sided—Indicates that only one side of the disk is capable of storing data.

slew rate—The speed at which the printhead moves to the next line, usually measured in lines per second.

soft-sectored—Indicates that the recording surface of the disk is marked magnetically at the beginning of each sector.

stand-alone modem—Indicates the modem is a separate unit; also called an external modem.

storage—Memory, usually expressed in bytes.

subscript—Characters reduced in size and printed slightly beneath the print line.
superscript—Characters reduced in size and printed slightly above the print line.
system software—A program or collection of programs that allows a computer system or a hardware expansion device to be employed by a particular computer.

telecomputing—Using telephone lines to send and receive data between two computers.
terminal emulators—Communications software that enables you to type information from the keyboard and send it through the modem.
text dump—A program for transferring the text screen to the printer.
timesharing—Dividing the computer's processor between several users who share the processing time.
tracks—The concentric rings on the disk surface.
tractor feed—A method of accurately positioning and moving fanfold paper through the printer. Perforations along the edge of the paper fit over the sprocket wheels.
transfer point—The voltage (approximately 108V) at which a standby power system starts supplying power to the computer.
transparent—Indicates the computer rather than the end user takes care of data transmission.
trim tabs—Slide switches on some joysticks that adjust the reading of the potentiometers so that the values returned lie within the normal expected values.

UPS—Uninterrupted Power System; a unit to protect you from blackouts, which cause loss of material and damage to the computer.

VA—Volt Ampere; a method used to measure the maximum output of a standby system. To convert this to watts or amps, add up the individual amp readings of all devices to be powered and multiply by 120. for example, a 3 amp system would be rated at 360 VA.
VDU—Video Display Unit; another name for the screen, it applies to both monitors and televisions.
vertical register—A register, when activated by the signal from a light pen, that latches in the vertical location of the electron beam.
video controller—The device that organizes the video information in the computer and sends it to the television or monitor.
video digitizer—A digitizer relying upon an electronic camera or upon electronic camera technology such as a VCR or videodisc player to provide input to the digitizing system in use.

write—To store data onto a disk or other permanent storage medium.
write-protect—To ensure a disk is not erased, by sliding a tab in the upper right-hand corner of a disk toward the edge of the disk and exposing a hole near the corner of the disk.
workstation—The computer console, screen, and keyboard used by an individual to perform tasks. Each workstation is attached via a cable to a central interface,

which allows them to share peripherals, data, and software.

Xon/Xoff protocol—A handshaking protocol used to indicate when data is ready to be transferred and when it is not.

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by Gary Phillips and Donald J. Scellato

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Suppose, for example, you're in the market for a printer. To get a complete and unbiased rundown of all the best available, just turn to the chapter on printers. You'll find over 20 models listed in a variety of price ranges and ranging from dot-matrix to daisy wheel and laser models, even specialized graphics printers.

Considering the purchase of a modem? Here's the expert advice you need to decide exactly which model fits both your needs and your pocketbook. And there's equally thorough information on printer interfaces, digitizers, disk drives, hard disks, memory expansion hardware, pointers and other input devices, as well as such specialized peripherals as power line monitors, spikes, signal conditioners, and standby power systems.

And there's more! You'll find specific details on how each device is interfaced or connected to your Mac . . . get a glossary of computer jargon to help you unravel the terms used by computer manufacturers . . . and much more. In fact, if you plan to buy any add-ons at all for your Mac, this is an essential time- and money-saving sourcebook!

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